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### (54) Patient lifting and transport apparatus and method

(57) A convertible patient lifting and transport apparatus 10 comprising a frame assembly 12,14,20 mounted on wheels 15,16,17,18. The frame assembly 12,14,20 defines a patient carriage zone. A patient support 64 is carried by the frame assembly 12,14,20. The patient support 64 is convertible for supporting the patient in the carriage zone in a generally supine position and in a seated position. A mechanical elevating assembly 50 is provided for lifting and lowering the patient support relative to the frame assembly 12,14,20. A frame conversion assembly 30,38,48,49,51 moves the frame assembly 12,14,20 between an open condition wherein the frame assembly 12,14,20 expands for straddling a bed when lifting and removing the patient from the bed, and a closed condition wherein the frame assembly 12,14,20 retracts outside of an area surrounding the bed for transporting the patient to a location away from the bed.

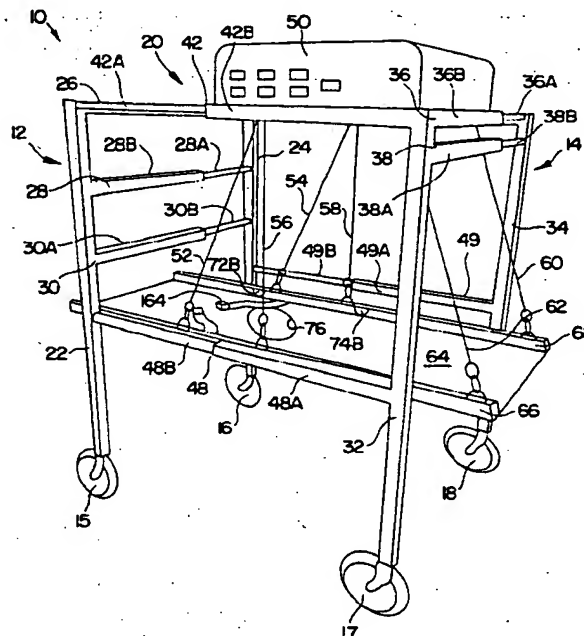


FIG. 1

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## Description

[0001] This invention relates to a convertible patient lifting and transport apparatus, and to a method of transporting a patient from the bed to the toilet, or other distant location, and then back to the bed. The invention is especially applicable for use in the health care industry to reduce the incidence of on-the job injury associated with manually lifting, handling and transferring patients. Injuries to the back and shoulder are most common.

[0002] Standard programs for health care injury prevention focus on body mechanics and back care, and the proper lifting techniques to employ when handling a patient. Notwithstanding this, injuries result even when proper body mechanics and lifting techniques are used. Lifting a patient is not simply overcoming a heavy weight. The patient's physical condition, size, shape, deformities, physical impairments, and weight are all factors impacting the manner in which a transfer is made. Some patients are combative and uncooperative. Patients can also be unpredictable, suddenly resisting movement and throwing caregivers off balance during a lift or transfer. Optimum posture is often difficult to maintain making the proper lifting technique impractical to follow.

[0003] Although mechanical and electromechanical lifting devices have been available for years, statistics showing physical overexertion from lifting and transferring bedridden patients remain unacceptable. Some nurses and other caregivers are reluctant to use such devices because of their many drawbacks and limitations. Among the disadvantages are the excessive time required to perform the lift and the instability of the patient in the device during the lift. Such devices can also aggravate sensitive skin, and typically place the patient in an embarrassing position when lifted. Moreover, these devices create storage problems, are difficult to manoeuvre, and generally cannot move sufficiently close to the patient's bed to effect a safe and proper transfer.

[0004] Many of the above problems were first addressed by the applicant in its prior issued patent, U.S. Patent No. 5,570,483.

[0005] According to one aspect of the present invention there is provided a convertible patient lifting and transport apparatus, the apparatus comprising a frame assembly mounted on roller means, the assembly defining a patient carriage zone for being occupied by a patient above the supporting surface; patient support means, carried by the frame assembly, for supporting a patient in the carriage zone; mechanical elevating means for lifting and lowering the patient support means relative to the frame assembly; frame assembly conversion means for moving the frame assembly between an open condition wherein the frame assembly expands to straddle a bed, to lift and remove the patient from the bed on the support means, and a closed condition

wherein the frame assembly retracts for transporting the patient to a location away from the bed.

[0006] The frame assembly preferably includes spaced-apart upstanding front and rear end frames, and a top frame arranged above the patient carriage zone interconnecting the front and rear end frames together. The front and rear end frames preferably include respective pairs of spaced-apart vertical support members and telescoping lateral cross braces interconnecting the vertical support members of each pair together. The top frame preferably includes first and second spaced-apart, telescoping longitudinal support members connected at their respective opposite ends to the pairs of spaced-apart vertical support members. Desirably, telescoping lateral cross braces interconnect the longitudinal support members together.

[0007] The patient support means advantageously includes a hammock. The hammock may be a fabric hammock. Preferably, a plurality of cables extend downwardly from the top frame for suspending the hammock in the patient carriage zone. The hammock desirably includes first and second longitudinal side bars attached at opposite side edges of the hammock. Preferably, each of the supports bars includes a back hinge for allowing upward pivoting movement of a back portion of the hammock to lift the patient from a generally supine position to a seated position.

[0008] Each of the side bars may further include a front hinge for allowing downward pivoting movement of a front portion of the hammock such that the legs of the patient can bend when in the seated position. The front hinge desirably includes ratchet means for adjustably setting the angle of the front portion of the hammock relative to the back portion of the hammock.

[0009] A safety belt is preferably attached to the hammock and is adapted for extending around the waist of the patient to secure the patient in the hammock.

[0010] The hammock advantageously includes an opening formed in a seat portion thereof for allowing use of a toilet by the patient without leaving the apparatus. Preferably, a disposable sanitary liner is placed at the opening of the hammock, and includes a cylindrical chute adapted for extending downwardly into the toilet upon use of the toilet by the patient. A flap may be attached to the underside of the hammock for covering the opening in the hammock before and after use of the toilet by the patient.

[0011] Desirably, a lateral spreader bar is attached to opposite side edges of the hammock. The spreader bar is preferably located between the hammock and the cables for maintaining the hammock in a laterally spread condition as the patient is lifted and lowered.

[0012] The mechanical elevating means preferably includes a motor assembly arranged on the top frame and operatively connected to the plurality of cables for lifting and lowering the cables to adjust the hammock between a horizontal condition and an upwardly folded condition.

[0013] The frame assembly conversion means preferably includes first and second linear actuators attached to the frame assembly for moving the frame assembly between the open and closed conditions the first linear actuator adjusting a widthwise dimension of the apparatus and the second linear actuator adjusting a lengthwise dimension of the apparatus.

[0014] The roller means are preferably wheels, adapted for rolling movement over a supporting surface.

[0015] According to the present invention there is further provided a method of transporting a patient including the steps of providing a transport apparatus including a convertible frame assembly mounted on roller means, the frame assembly being movable between an open condition and a closed condition; moving the frame assembly in the open condition to a position straddling the bed of the patient; positioning the patient on support means carried by the frame assembly; the support means supporting the patient in a carriage zone defined by the frame assembly; moving the frame assembly away from its position straddling the bed with the patient located in the carriage zone; converting the frame assembly from the open condition to the closed condition to reduce its widthwise and lengthwise dimension; transporting the patient to the location away from the bed; upon return of the patient to the bed; converting the frame assembly back to the open condition to increase its widthwise and lengthwise dimension, such that the frame assembly is moveable back to the location straddling the bed to unload the patient onto the bed.

[0016] Preferably the support means is adjusted from a generally horizontal condition to an upwardly folded condition after positioning the patient onto the support means and prior to converting the frame assembly from the open condition to the closed condition.

[0017] The present invention further provides a convertible patient lifting and transport apparatus including a frame assembly mounted on roller means; the frame assembly defining a patient carriage zone for being occupied by a patient above the supporting surface; patient support means carried by the frame assembly for supporting the patient in the carriage zone; patient support conversion means for moving the patient support means between a generally horizontal condition wherein the patient lies supine in the carriage zone, and an upwardly folded condition wherein the patient sits generally upright in the carriage zone. The roller means are preferably wheels, adapted for rolling movement over a supporting surface.

[0018] The present invention also provides a convertible patient lifting and transport apparatus, comprising a frame assembly comprising spaced-apart upstanding front and rear end frames mounted on wheels for rolling movement of the frame assembly over a supporting surface, the front and rear end frames comprising respective pairs of spaced-apart vertical support members and telescoping lateral cross braces interconnecting the ver-

tical support members of each pair together, and the frame assembly further comprising a top frame interconnecting the front and rear end frames together, the top frame comprising first and second spaced-apart, telescoping longitudinal support members connected at their respective opposite ends to the pairs of spaced-apart vertical support members, and telescoping lateral cross braces interconnecting the longitudinal support members together, and the frame assembly defining a patient carriage zone between the front and rear end frames and the top frame for being occupied by a patient above the supporting surface; patient support means comprising a fabric hammock, and a plurality of cables extending downwardly from the top frame for suspending the hammock in the patient carriage zone; mechanical elevating means comprising a motor assembly arranged on the top frame and operatively connected to the plurality of cables for lifting and lowering the cables to adjust the hammock between a generally horizontal condition and an upwardly folded condition; and frame assembly conversion means for moving the frame assembly between an open condition wherein the frame assembly expands for straddling a bed of the patient when lifting and removing the patient from the bed, and a closed condition wherein the frame assembly retracts for transporting the patient to a location away from the bed.

[0019] The frame assembly conversion means preferably comprises a linear actuator attached to the frame assembly and adapted for selectively increasing and decreasing the space between the longitudinal support members of the top frame, thereby increasing and decreasing the width of the apparatus.

[0020] The frame assembly conversion means desirably comprises a linear actuator attached to the frame assembly and adapted for selectively increasing and decreasing the space between the front and rear end frames, thereby increasing and decreasing the length of the apparatus.

[0021] The hammock desirably includes first and second longitudinal side bars attached at respective opposite side edges of the hammock. Each of the side bars preferably includes a back hinge for allowing upward pivoting movement of a back portion of the hammock to lift the patient from a generally supine position to a seated position.

[0022] Each of the bars may further include a front hinge for allowing downward pivoting movement of a front portion of the hammock such that the legs of the patient can bend when in the seated position. The front hinge advantageously includes ratchet means for adjustably setting the angle of the front portion of the hammock relative to the back portion of the hammock.

[0023] A safety belt may be attached to the hammock and adapted for extending around the waste of the patient to secure the patient in the hammock.

[0024] The hammock preferably includes an opening formed in a seat portion thereof for allowing use of a toi-

let by the patient without leaving the apparatus. A disposable sanitary liner is preferably provided placed at the opening of the hammock, and including a cylindrical chute adapted for extending downwardly into the toilet upon use of the toilet by the patient. Desirably, a flap is attached to an underside of the hammock for covering the opening in the hammock before and after use of the toilet by the patient.

[0025] Preferably a lateral spreader bar is attached to opposite side edges of the hammock and located between the hammock and the cables for maintaining the hammock in a laterally spread condition as the patient is lifted and lowered.

[0026] A specific example of the present invention will now be described in more detail, by way of example only, with reference to the accompanying drawings, in which:

Figure 1 is a front end perspective view of the patient lifting and transport apparatus according to one preferred embodiment of the invention;

Figure 2 is a side perspective view of the patient lifting and transport apparatus;

Figure 3 is an enlarged, fragmentary perspective view of the hammock;

Figure 4 is an enlarged, fragmentary perspective view of the hammock with the seat portion torn away to show the releasable flap for covering the oval opening;

Figure 5 is an enlarged, fragmentary perspective view of the hammock with the seat portion torn away and showing the sanitary liner positioned over the oval opening;

Figure 6A is an elevational view of the spreader bar adapted for use at the foot end and head end of the hammock for preventing the hammock from sagging inwardly under the weight of the patient when lifted;

Figure 6B is a perspective view of a second spreader bar adapted for use adjacent a back side of the hammock for supporting the back of the patient when in a seated position;

Figure 7 is an elevational view of the motor assembly with the top of the motor housing removed and showing attachment of the cables to the hammock;

Figure 8 is a top plan view of the motor assembly with the top of the motor housing removed;

Figure 9 is a front end perspective view of the apparatus with the actuator removed for clarity, and showing the apparatus expanded in a widthwise dimension;

Figure 10 is a front end perspective view of the apparatus with the actuator removed for clarity, and showing the apparatus retracted in the widthwise dimension;

Figure 11 is a side perspective view of the apparatus in the closed condition with the hammock converted into a seat;

Figure 12 is a rear perspective view of the apparatus in the closed condition and showing the gate pivoted to a position adjacent the rear end frame;

Figures 13-27 are views illustrating sequential application of the apparatus for lifting and transporting the patient from the bed to the toilet;

Figure 28 is a plan view illustrating the layout of a standard semi-private hospital room;

Figure 29 is a plan view demonstrating transport of a non-window patient from the bed to the bathroom; and

Figure 30 is a plan view demonstrating transport of a window patient from the bed to the bathroom.

[0027] Referring now specifically to the drawings, a patient lifting and transport apparatus according to the present invention is illustrated in Figure 1 and shown generally at reference numeral 10. The apparatus 10 is particularly applicable for lifting and transporting a patient from a bed to the toilet without physical strain or risk of injury to the caregiver.

[0028] As shown in Figures 1 and 2, the apparatus 10 includes spaced-apart upstanding front and rear end frames 12 and 14 mounted on wheels 15, 16, 17, and 18, and a top frame 20 connected to the front and rear end frames 12, 14. The front end frame 12 includes vertical support members 22 and 24 and telescoping lateral cross braces 26 and 28 connecting the vertical support members 22, 24 together. Each cross brace 26, 28 has a slide rod 26A, 28A adapted for telescoping sliding movement within a larger hollow guide rod 26B, 28B. The guide rod 26B, 28B preferably includes an internal bearing (not shown) to facilitate axial movement of the slide rod 26A, 28A.

[0029] A linear actuator 30 is connected to the vertical support members 22, 24 below the cross brace 28 and includes a DC electric motor (not shown), a hollow screw shaft 30A, and a drive shaft 30B adapted for linear movement into and out of the screw shaft 30A. The DC motor actuates a worm gear which transmits power to an acme screw contained in the screw shaft 30A. Rotation of the screw actuates the drive shaft 30B. According to one embodiment, the actuator 30 is manufactured by SKF of Bethlehem, Pa. and sold under the trademark CATR 33.

[0030] The rear end frame 14 includes spaced-apart vertical support members 32 and 34 and a telescoping lateral cross brace 36 connecting the vertical support members 32, 34 together. The lateral cross brace 36 has a slide rod 36A adapted for telescoping sliding movement within a larger hollow guide rod 36B. A linear actuator 38, as described above, is connected to the vertical support members 32, 34 and includes a DC electric motor (not shown), a hollow screw shaft 38A, and a drive shaft 38B adapted for linear movement into and out of the screw shaft 38A. The cross brace 36 and linear actuator 38 are located at the top of the rear end frame 14 to define an opening sufficient for moving the

apparatus 10 directly over the bed of the patient.

[0031] The top frame 20 includes spaced-apart, telescoping longitudinal support members 42 and 44 connected at their respective opposite ends to the vertical support members 22, 24 and 32, 34 of the front and rear end frames 12, 14, and a telescoping lateral cross brace 46. Each of the longitudinal support members 42, 44 and lateral cross brace 46 has a slide rod 42A, 44A, and 46A adapted for telescoping sliding movement within a larger hollow guide rod 42B, 44B, and 46B. A second pair of linear actuators 48 and 49 are connected at respective opposite ends to the vertical support members 22, 24 and 32, 34 of the front and rear end frames 12, 14 below the longitudinal support members 42, 44. Each linear actuator 48, 49 includes a DC electric motor (not shown), a hollow screw shaft 48A, 49A, and a drive shaft 48B, 49B adapted for linear movement into and out of the screw shaft 48A, 49A.

[0032] The longitudinal support member 42 and cross braces 46 and 36 cooperate to support an overhead motor housing 50 enclosing a motor assembly 51 (See Figures 7 and 8). A number of cables 52, 54, 56, 58, 60, and 62 extend downwardly from the motor housing 50 and are removably attached to a flexible fabric hammock 64 adapted for carrying the patient. As best shown in Figures 3-5, the hammock 64 includes opposing, generally flat longitudinal side bars 66 and 68 with respective pairs of front and back flat hinges 72A, 72B and 74A, 74B for converting the hammock 64 from a generally horizontal support to a seat. The front hinges 72A, 72B are preferably ratcheted to allow angle adjustment of the foot end of the hammock 64 relative to a seat portion of the hammock 64. The back hinges 74A, 74B allow the hammock 64 to pivot freely between a generally horizontal condition and an upwardly folded condition.

[0033] An oval opening 76 is formed in the seat portion of the hammock 64 for allowing the patient to use the toilet without leaving the apparatus 10. Preferably, a fabric flap 78 is attached to the underside of the hammock 64 and includes a perimeter area of loop material 80 adapted for releasibly mating with complementary hooks (not shown) attached to the underside of the hammock 64 to cover the opening 76. As shown in Figure 5, a disposable sanitary liner 82 is preferably laid over the oval opening 76 prior to positioning the patient on the hammock 64. The liner 82 includes a paper sheet 84 with a central opening 86 and attached biodegradable plastic chute 88 which dissolves in water. Upon transfer of the patient to the toilet, the fabric flap 78 is released and the chute 88 extended through the oval opening 76. The chute 88 is preferably perforated for convenient detachment from the paper sheet 84 and disposal after use.

[0034] Referring again to Figures 1 and 2, seat support cables 52, 54, 56, and 58 are attached to the hinged side bars 66 and 68 adjacent the seat portion of the hammock 64. Back support cables 60 and 62 are

attached to the side bars 66 and 68 adjacent the head end of the hammock 64 and are adapted for supporting the upper torso of the patient. The cables 52, 54, 56, 58, 60, and 62 cooperate to carry the patient in the hammock 64 in a patient carriage zone, and are manipulated by the motor assembly 51 to lift and lower the patient and to move the patient from a generally supine position to a seated position, as described further below. Spreader bars 90, such as shown in Figure 6A, may be used at the foot end and head end of the hammock 64 to prevent the hammock 64 from sagging inwardly as the patient is lifted and transported. The ends 92 and 94 of each spreader bar 90 are attached to the side bars 66 and 68 of the hammock 64. The cables are attached at points 96 and 98. An arcuate spreader bar 99, as shown in Figure 6B, may be used adjacent a back side of the hammock 64 for supporting the back of the patient when in a seated position. Notches 99A and 99B are preferably formed at opposite ends of the spreader bar 99 for engaging fabric handles (not shown) attached to respective side edges of the hammock 64. When not in use, the spreader bars 90 and 99 are conveniently secured to the top frame 20 for storage.

[0035] As shown in Figures 7 and 8, the motor assembly 51 includes a pair of DC electric motors 100 and 102 each having opposed rotating drive shafts 104A, 104B and 106A, 106B adapted for simultaneously winding and unwinding the support cables 52, 54, 56, 58, 60, and 62 onto and from respective take-up rolls 108, 110, 112, and 114. The seat support cables 52, 54, 56, and 58 are attached to take-up rolls 108 and 110 and extend through a series of guide pulleys 116, 118, 120, 122, 124, 126, 128, and 130 and over stationary pulleys 132A, 132B, 134A, and 134B outwardly through openings 136, 138, 140, and 142 formed in the bottom wall 144 of the motor housing 50 to the hammock 64. The back support cables 60 and 62 are attached to take-up rolls 112 and 114 and extend through guide pulleys 146, 148, 150, and 152 and over stationary pulleys 154 and 156 outwardly through openings 158 and 160. Simultaneous rotation of all of the take-up rolls 108, 110, 112, and 114 operates to lift and lower the hammock 64. Rotation of only take-up rolls 112 and 114 lifts the head end of the hammock 64 allowing the patient to sit in a generally upright position.

[0036] Conversion of the apparatus 10 from a fully expanded open condition, shown in Figure 9, to a fully retracted closed condition, shown in Figure 11, is achieved by first actuating linear actuators 30 and 38 to reduce the widthwise dimension of the apparatus 10, as shown in Figure 10. The slide rods 26A, 28A, 36A, and 46A of the front and rear end frames 12 and 14 and top frame 20 telescope inwardly within their corresponding hollow guide rods 26B, 28B, 36B, and 46B. The head end of the hammock 64 is then raised by the motor assembly 51, as previously described. The foot end of the hammock 64 is raised slightly to disengage front ratchet hinges 72A and 72B and then manually lowered

to the desired angle. Finally, the lengthwise dimension of the apparatus 10 is reduced by actuating linear actuators 48 and 49. The slide rods 42A and 44A of the top frame 20 telescope inwardly within their corresponding hollow guide rods 42B and 44B.

[0037] As best shown in Figure 12, the apparatus 10 preferably further includes a gate 162 pivotally attached to the vertical support 34 and including a storage compartment for containing all batteries (not shown) necessary for operating the electrical motors 100 and 102 of the motor assembly 51 and linear actuators 30, 38, 48, and 49. For added back support, the gate 162 is pivoted to a position adjacent the rear end frame 14 to reside against the back of the patient when seated.

[0038] To use the apparatus 10, the patient "P" is first positioned on the hammock 64 by the caregiver "C" and a safety belt 164 fastened around the patient's waist. See Figures 13 and 14. The apparatus 10 in the open condition, as shown in Figures 15 and 16, is then rolled by the caregiver "C" over the bed "B" with the patient "P" in a supine position. The ends of cables 52, 54, 56, 58, 60, and 62 are attached to the side bars 66 and 68 of the hammock 64, as shown in Figure 17, or optionally, one or more spreader bars 90 (See Figure 6). The motor assembly 51 is then activated and the patient "P" lifted and removed from over the bed "B", as shown in Figures 18 and 19.

[0039] Referring to Figures 20-24, the patient "P" is moved from the supine position to a seated position by actuating motor 102 of the motor assembly 51 to lift the head end of the hammock 64. The foot end of the hammock 64 is raised slightly by the caregiver "C" to disengage the ratchet hinges 72A and 72B, and is then manually lowered to the desired angle. Linear actuators 30, 38, 48 and 49 cooperate to close the length and width of the apparatus 10, as previously described.

[0040] The apparatus 10 is then rolled by the caregiver "C" into the bathroom to a position over the toilet "T", as shown in Figures 25 and 26. With the sanitary liner 82 in place beneath the patient, the flap 78 is released from the underside of the hammock 64 and the plastic chute 88 extended downwardly into the toilet "T". This process may be facilitated by activating motor 100 to lift the patient "P" slightly. Once the chute 88 is in place, motor 100 may be further activated to lower the patient "P" closer to the toilet "T". When the patient "P" is finished, the chute 88 is torn away from the paper sheet 84 and disposed of down the toilet in "T". The apparatus 10 is moved by the caregiver "C" away from the toilet "T", as shown in Figure 27, and the patient "P" cleaned and transported back to the room.

[0041] Figures 28-30 illustrate manoeuvring of the apparatus 10 within a standard semi-private hospital room 170 including a bathroom 172, a window 174, and a partition 176 dividing the room 170 into separate areas 170A and 170B. A typical layout of the room 170 is shown in Figure 28. Each area 170A and 170B gen-

erally includes a bed 180A, 180B, a chair 182A, 182B, bedside table 184A, 184B, and over-bed table 186A, 186B. As shown in Figure 29, to effect transfer of a non-window patient, the bed 180A is shifted and the bedside table 184A and over-bed table 186A moved against the partition 176. The apparatus 10 is then rolled to the entrance of the bathroom 172 and converted to the closed condition, as previously described. In the closed condition, the apparatus 10 enters the bathroom 172 and is moved over the toilet 188.

[0042] Transfer of a window patient is shown in Figure 30. The bedside table 184B and over-bed table 186B are moved as shown, and the apparatus 10 rolled to the entrance of the bathroom 172 where it converts to the closed condition. In the closed condition, the apparatus 10 enters the bathroom 172 and is moved over the toilet 188.

[0043] The above described embodiment thus provides a patient lifting and transport apparatus which allows transfer of a patient from the bed to the bathroom without any manual lifting or handling. The apparatus converts between an open expanded condition and a closed retracted condition, and is capable of moving the patient between a generally supine position and a seated position.

[0044] The apparatus further allows the patient to use the toilet without leaving the apparatus. The apparatus can be conveniently operated by a single carer, and will substantially reduce the incidence of on-the-job injury in the health care industry.

[0045] The apparatus is completely self-contained. The apparatus can be moved directly over the bed of the patient, and can be moved directly over a toilet.

[0046] The invention also provides a method of transferring a patient between the bed and a location away from the bed without requiring manual lifting or handling.

[0047] Various modifications can be made to the apparatus and method as described above without departing from the scope of the present invention.

## Claims

1. A convertible patient lifting and transport apparatus (10), comprising:

- (a) a frame assembly (12,14,20) mounted on roller means (15,16,17,18), the assembly defining a patient carriage zone;
- (b) patient support means (64) carried by the frame assembly (12,14,20) for supporting a patient in the carriage zone;
- (c) mechanical elevating means (50) for lifting and lowering the patient support means (64) relative to the frame assembly (12,14,20); and
- (d) frame assembly conversion means (30,38,48,49,51) for moving the frame assembly (12,14,20) between an open condition

wherein the frame assembly (12,14,20) expands to straddle a bed when lifting and removing the patient from the bed, and a closed condition wherein the frame assembly (12,14,20) retracts for transporting the patient to a location away from the bed.

2. Apparatus according to claim 1, characterised in that the frame assembly comprises spaced-apart upstanding front (12) and rear (14) end frames, and a top frame (20) arranged above the patient carriage zone and interconnecting the front (12) and rear (14) end frames together.
3. Apparatus according to claim 2, characterised in that the front (12) and rear (14) end frames comprise respective pairs of spaced-apart vertical support members (22,24,32,34) and telescoping lateral cross braces (26,28,36) interconnecting the vertical support members (22,24,32,34) of each pair together.
4. Apparatus according to claim 3, characterised in that the top frame (20) comprises first and second spaced-apart, telescoping longitudinal support members (42,44) connected at their respective opposite ends to the pairs of spaced-apart vertical support members (22,24,32,34) of the front (12) and rear (14) end frames, and telescoping lateral cross braces (46) interconnecting the longitudinal support members (42,44) together.
5. Apparatus according to any of claims 2 to 4, characterised in that the patient support means comprises a hammock (64), and a plurality of cables (52,54,56,58,60,62) extending downwardly from the top frame (20) for suspending the hammock (64) in the patient carriage zone.
6. Apparatus according to claim 5 characterised in that the hammock (64) is a fabric hammock.
7. Apparatus according to claims 5 or 6, characterised in that the hammock (64) includes first and second longitudinal side bars (66,68) secured to opposite side edges of the hammock (64).
8. Apparatus according to claim 7, characterised in that each of the side bars (66,68) includes a back hinge (72B,74B) for allowing upward pivoting movement of a back portion of the hammock (64) to lift the patient from a generally supine position to a seated position.
9. Apparatus according to claim 8, characterised in that each of the side bars (66,68) includes a front hinge (72A,74A) for allowing downward pivoting movement of a front portion of the hammock (64)

such that the legs of the patient can bend when in the seated position.

10. Apparatus according to claim 9, characterised in that the front hinge (72A,74A) includes ratchet means for adjustably setting the angle of the front portion of the hammock (64) relative to the back portion of the hammock (64).
11. Apparatus according to any of claims 5 to 10, characterised in that a safety belt (164) is attached to the hammock (64) and adapted for extending around the waist of the patient to secure the patient in the hammock (64).
12. Apparatus according to any of claims 5 to 11, characterised in that the hammock (64) includes an opening (76) formed in a seat portion thereof for allowing use of a toilet by the patient without leaving the apparatus (10).
13. Apparatus according to claim 12, characterised in that a disposable sanitary liner (82) is placed at the opening (76) of the hammock (64), the sanitary liner (82) including a cylindrical chute (88) adapted for extending downwardly into the toilet upon use of the toilet by the patient.
14. Apparatus according to claims 12 or 13, characterised in that a flap (78) is attached to an underside of the hammock (64) for covering the opening (76) in the hammock (64) before and after use of the toilet by the patient.
15. Apparatus according to any of claims 5 to 14, characterised in that a lateral spreader bar (90) is attached to opposite side edges of the hammock (64) and located between the hammock (64) and the cables (52,54,56,58,60,62) for maintaining the hammock (64) in a laterally spread condition as the patient is lifted and lowered.
16. Apparatus according to any of claims 5 to 15, characterised in that the mechanical elevating means (50) comprises a motor assembly (51) arranged on the top frame (20) and operatively connected to the plurality of cables (52,54,56,58,60,62) for lifting and lowering the cables to adjust the hammock (64) between a generally horizontal condition and an upwardly folded condition.
17. Apparatus according to any preceding claim, characterised in that the frame assembly conversion means (30,38,48,49,51) comprises a linear actuator (30,38) attached to the frame assembly (12,14,20) and adapted for selectively increasing and decreasing the space between the longitudinal support members (42,44) of the top frame (20),



thereby increasing and decreasing the width of the apparatus (10).

18. Apparatus according to any preceding claim, characterised in that the frame assembly conversion means (30,38,48,49,51) comprises a linear actuator (48,49) attached to the frame assembly (12,14,20) and adapted for selectively increasing and decreasing the space between the front (12) and rear (14) end frames, thereby increasing and decreasing the length of the apparatus (10).

19. Apparatus according to any preceding claim, characterised in that the frame assembly conversion means (30,38,48,49,51) comprises first and second linear actuators (30,38,48,49) attached to the frame assembly (12,14,20) for moving the frame assembly (12,14,20) between the open and closed conditions, the first linear actuator (30,38) adjusting a widthwise dimension of the apparatus (10) and the second linear actuator (48,49) adjusting a lengthwise dimension of the apparatus (10).

20. Apparatus according to any preceding claim characterised in that the roller means are wheels (15,16,17,18) adapted for rolling movement over a supporting surface.

21. A method of transporting a patient comprising the steps of:

- (a) providing a transport apparatus (10) comprising a convertible frame assembly (12,14,20) mounted on roller means (15,16,17,18), the frame assembly being movable between an open condition and a closed condition;
- (b) moving the frame assembly (12,14,20) in the open condition to a position straddling the bed of the patient;
- (c) positioning the patient on support means (64) carried by the frame assembly (12,14,20), the support means (64) supporting the patient in a carriage zone defined by the frame assembly (12,14,20);
- (d) moving the frame assembly (12,14,20) away from its position straddling the bed with the patient located in the carriage zone;
- (e) converting the frame assembly (12,14,20) from the open condition to the closed condition to reduce its widthwise and lengthwise dimension;
- (f) transporting the patient to a location away from the bed; and
- (g) upon return of the patient to the bed, converting the frame assembly (12,14,20) back to the open condition to increase its widthwise and lengthwise dimension, such that the frame

assembly (12,14,20) is moveable back to the position straddling the bed to unload the patient onto the bed.

22. A method according to claim 21, characterised by the step of adjusting the support means (64) to move the patient from a generally supine position to a seated position.

23. A convertible patient lifting and transport apparatus (10), comprising:

- (a) a frame assembly (12,14,20) mounted on roller means (15,16,17,18), the frame assembly (12,14,20) defining a patient carriage zone;
- (b) patient support means (64) carried by the frame assembly (12,14,20) for supporting the patient in the carriage zone; and
- (d) patient support conversion means (50) for moving the patient support means (64) between a generally horizontal condition wherein the patient lies supine in the carriage zone, and an upwardly folded condition wherein the patient sits generally upright in said carriage zone.

24. Apparatus according to claim 23 characterised in that the roller means are wheels (15,16,17,18), adapted for rolling movement over a support surface.

25. Apparatus according to claims 23 or 24, characterised in that the patient support means comprises a hammock (64), and a plurality of cables (52,54,56,58,60,62) extending from the frame assembly (12,14,20) for suspending the hammock (64) in the patient carriage zone.

26. Apparatus according to claim 25 characterised in that the hammock (64) is a fabric hammock.

27. Apparatus according to claims 25 or 26, characterised in that the hammock (64) includes first and second longitudinal side bars (66,68) secured to opposite side edges of the hammock (64).

28. Apparatus according to claim 27, wherein each of the side bars (66,68) includes a back hinge (72B,74B) for allowing upward pivoting movement of a back portion of the hammock (64) to lift the patient from a generally supine position to a seated position.

29. Apparatus according to claim 28, characterised in that each of the side bars (66,68) includes a front hinge (72A,74A) for allowing downward pivoting movement of a front portion of the hammock (64) such that the legs of the patient can bend when in



the seated position.

30. Apparatus according to claim 29, characterised in that the front hinge (72A,74A) includes ratchet means for adjustably setting the angle of the front portion of the hammock (64) relative to the back portion of the hammock (64). 5
31. Apparatus according to any of claims 25 to 30, characterised in that the patient support conversion means comprises a motor assembly arranged on the frame assembly and operatively connected to the plurality of cables for selectively lifting and lowering the cables to convert the hammock between the horizontal condition wherein the patient lies supine in the carriage zone, and the upwardly folded condition wherein the patient sits generally upright in the carriage zone. 10 15

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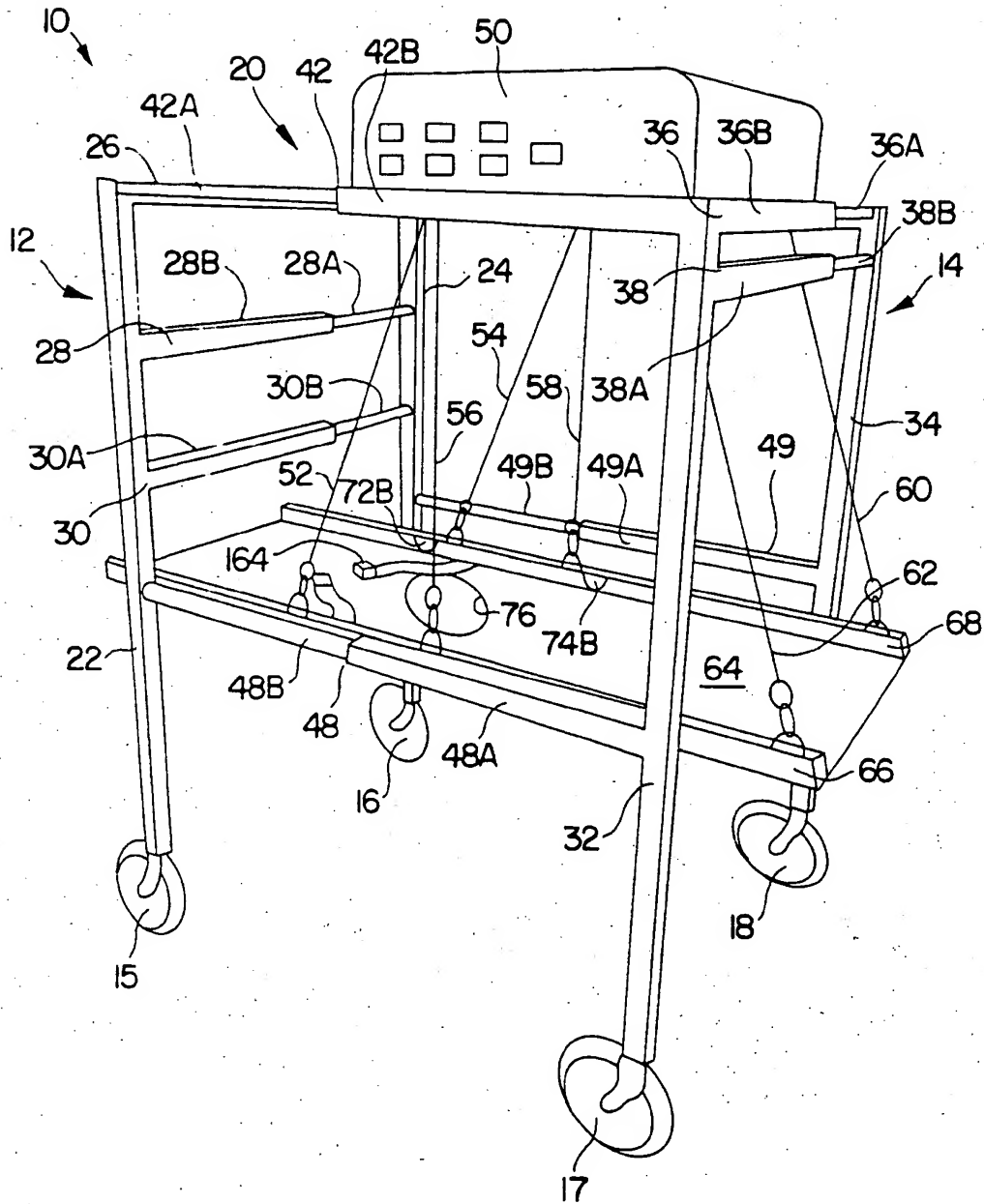


FIG. I

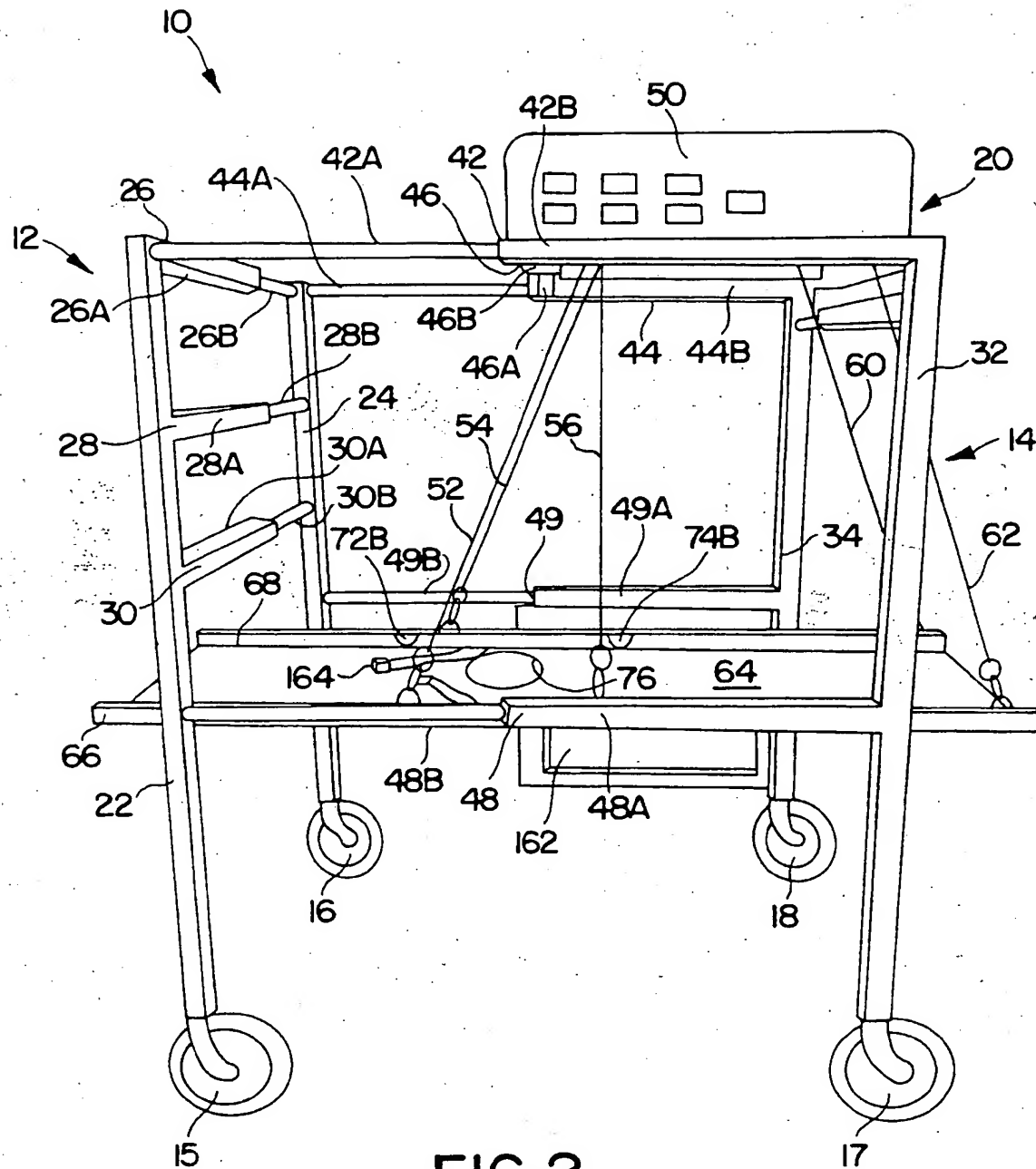


FIG. 2

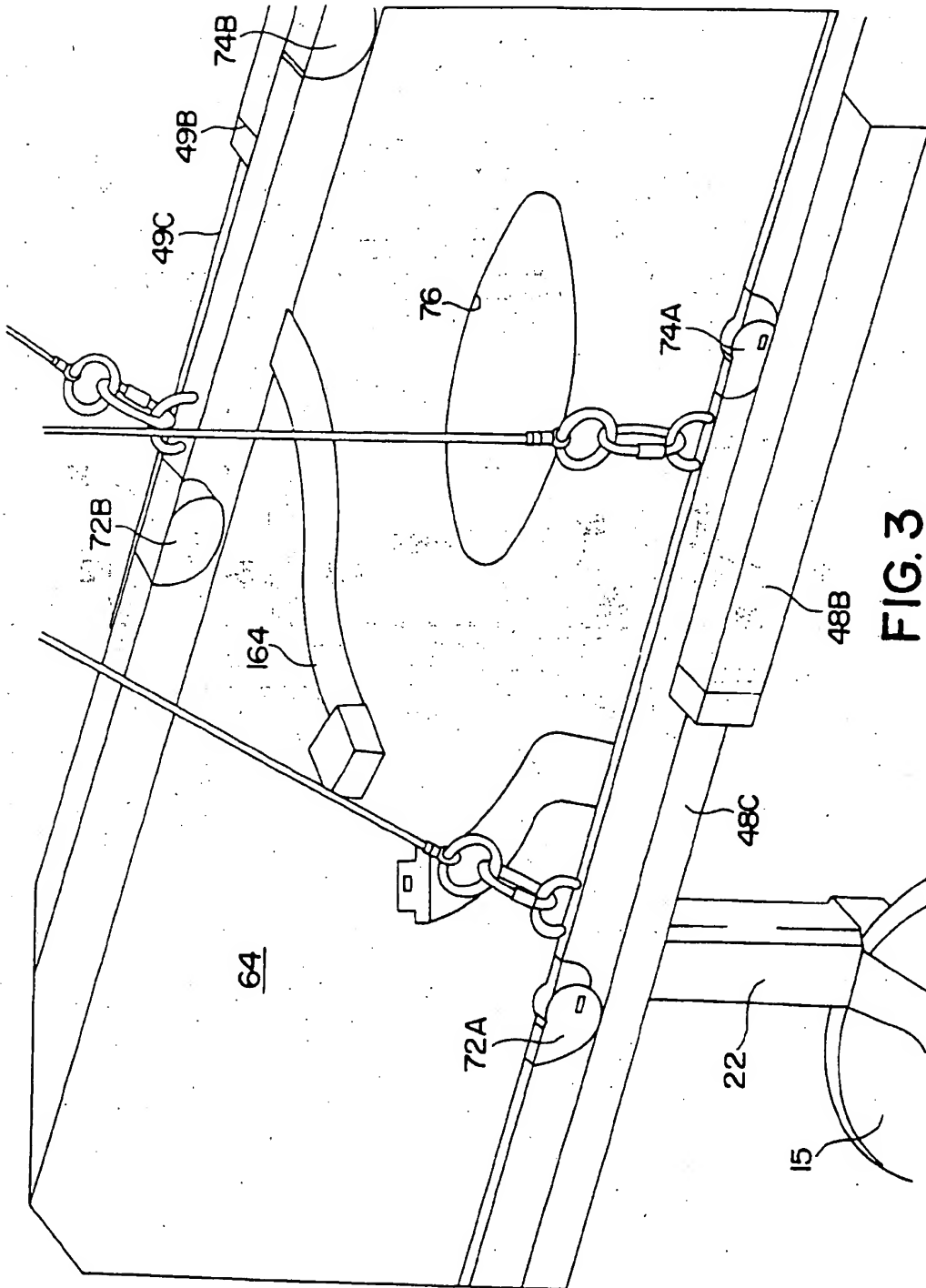


FIG. 3

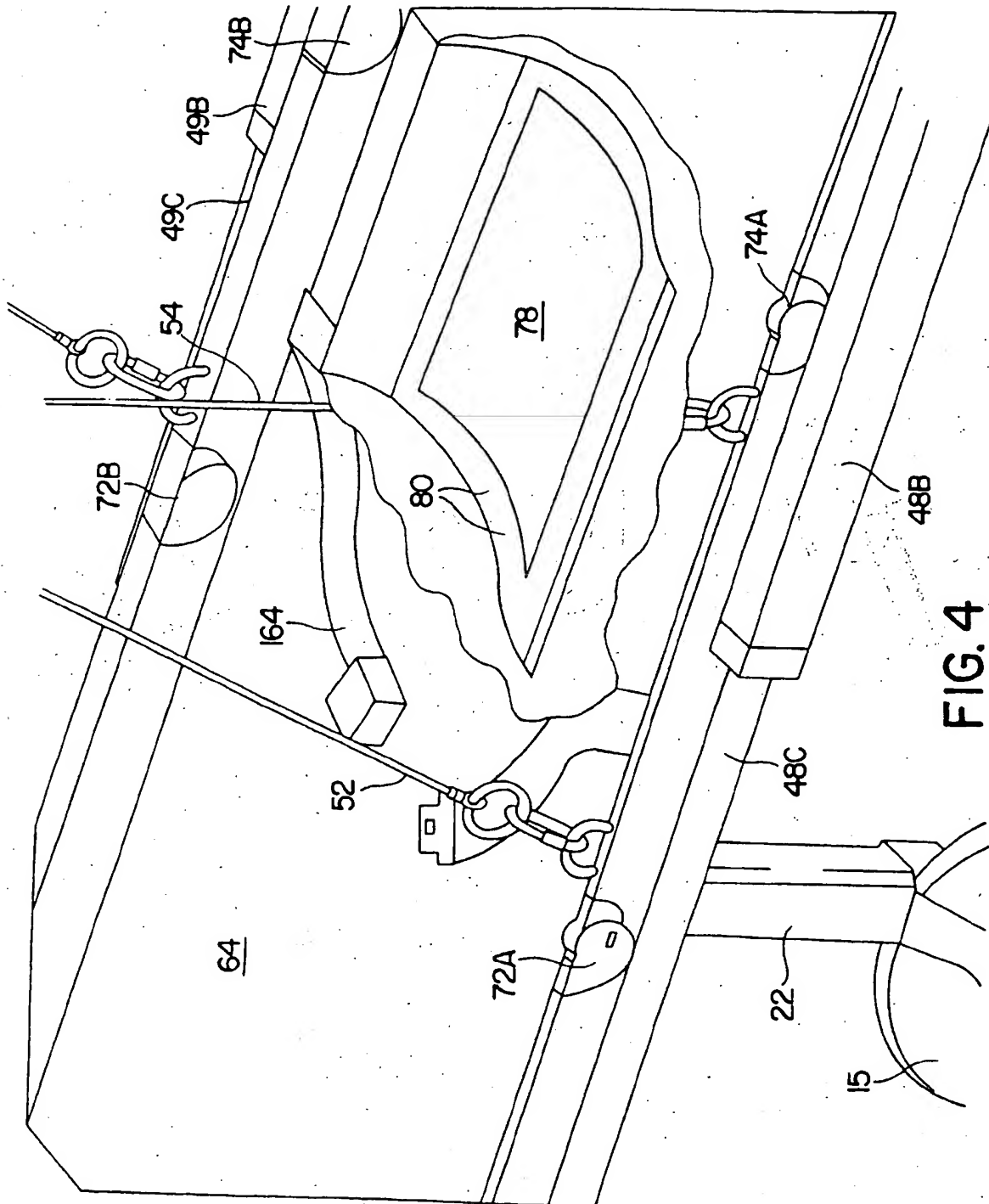
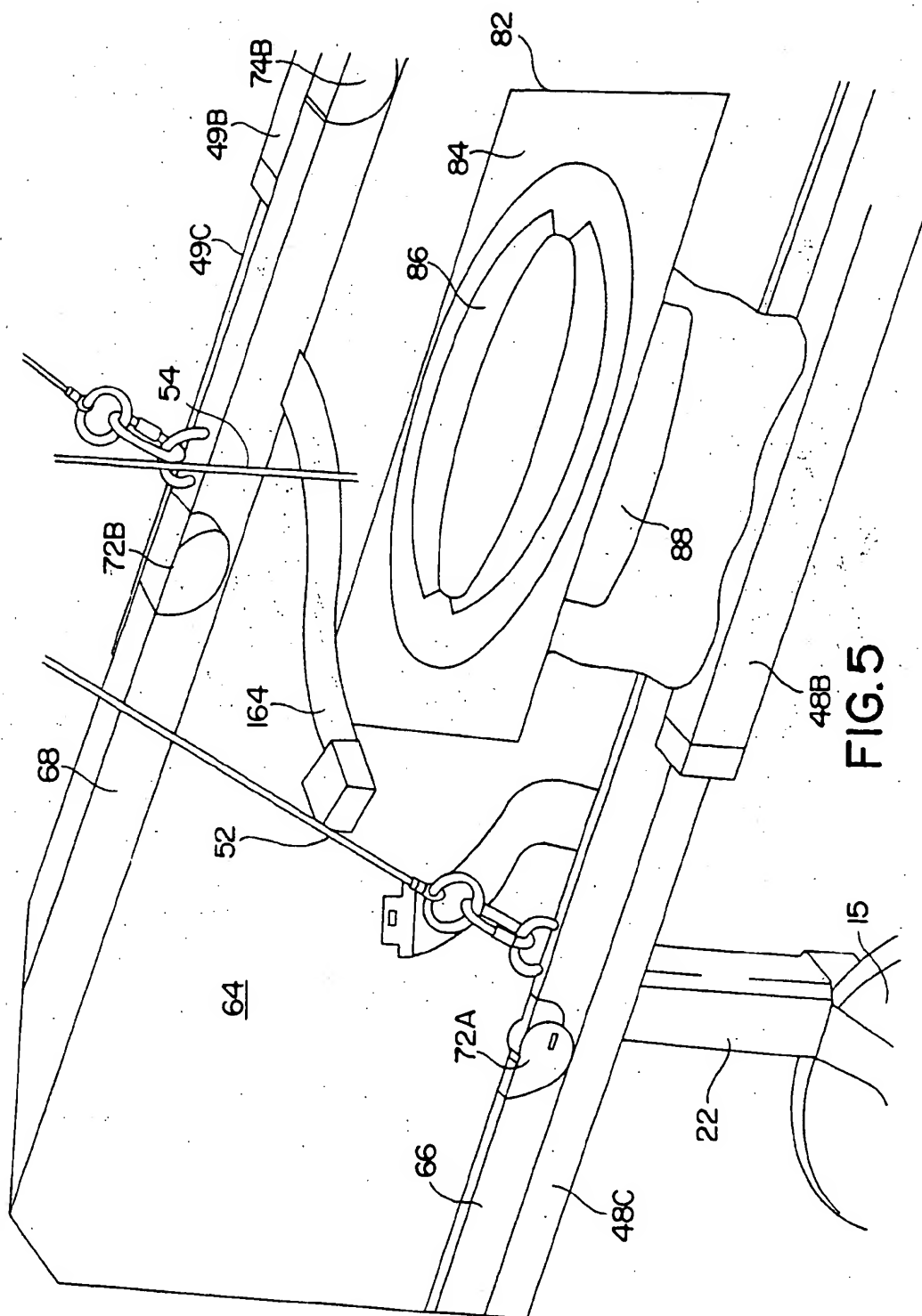


FIG. 4



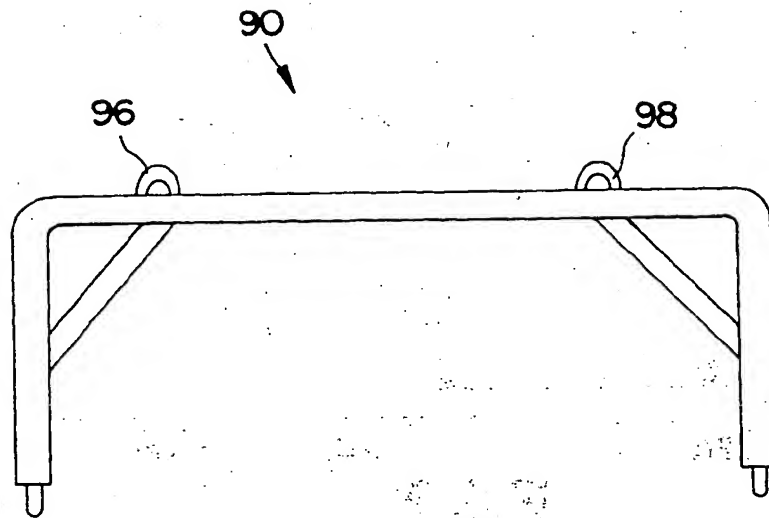


FIG. 6A



FIG. 6B



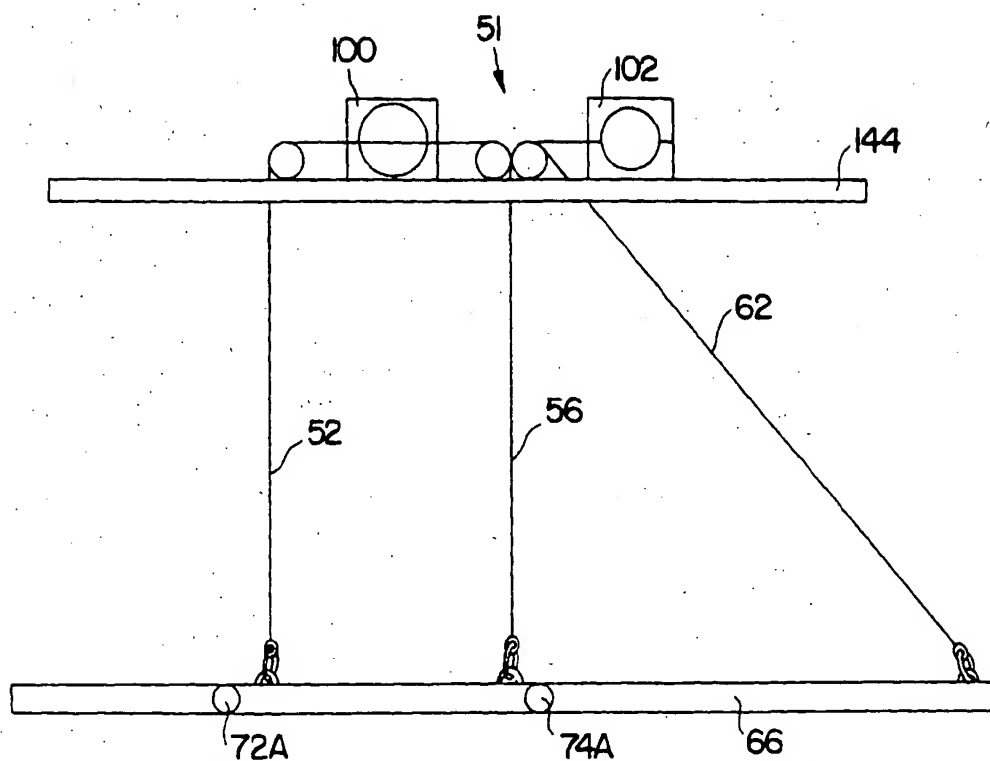
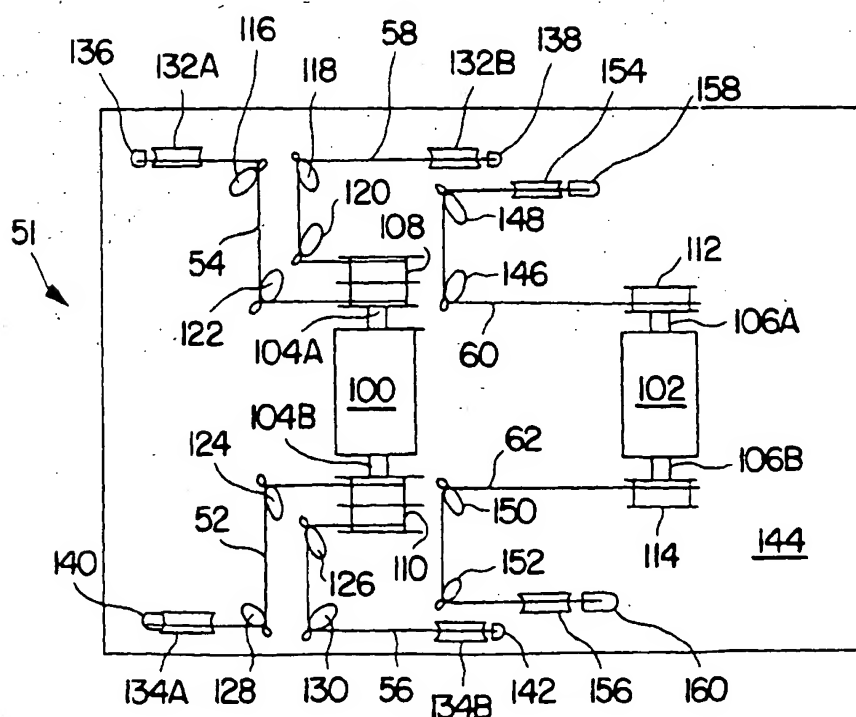


FIG. 7



**FIG.8**

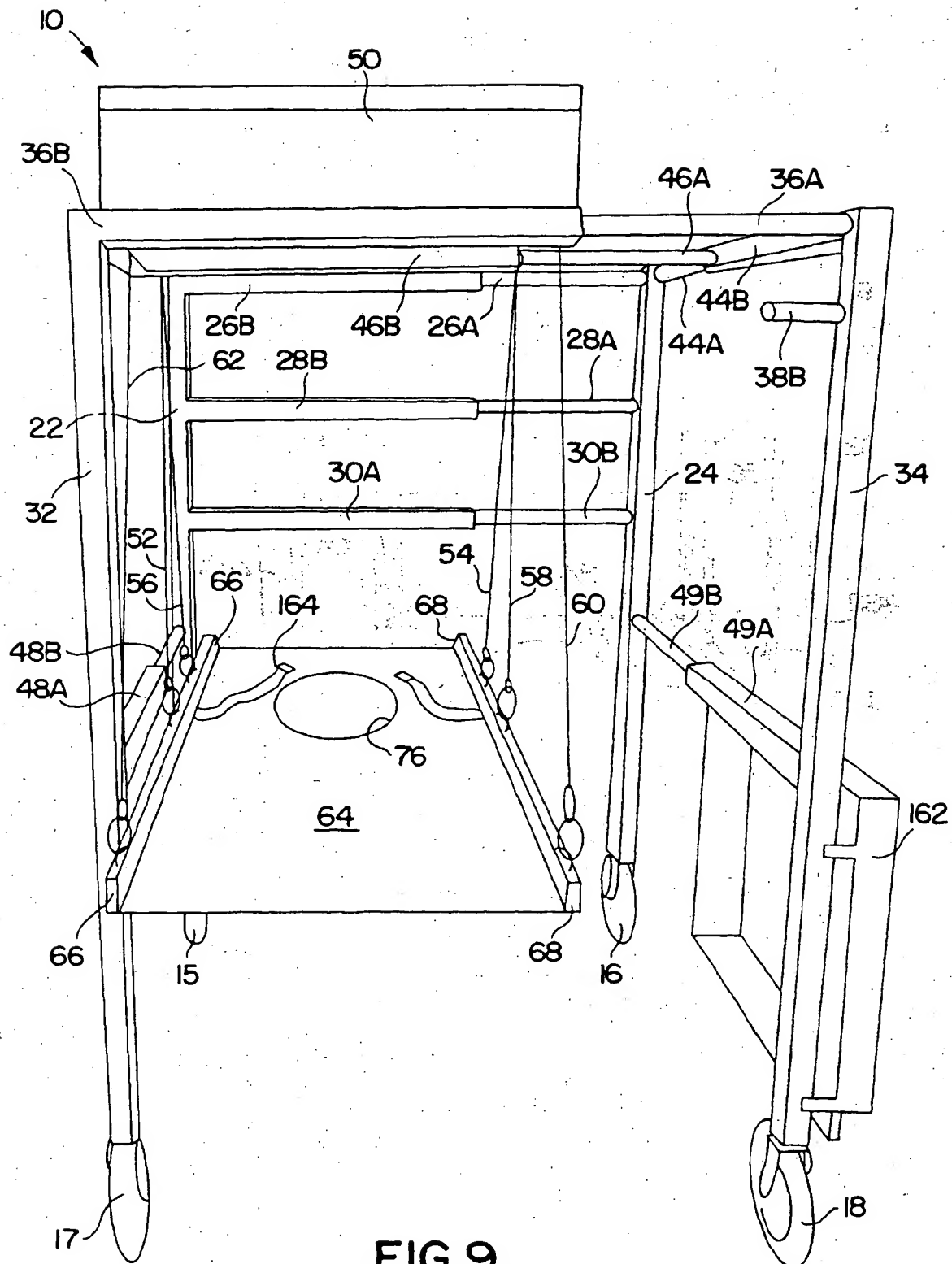


FIG. 9

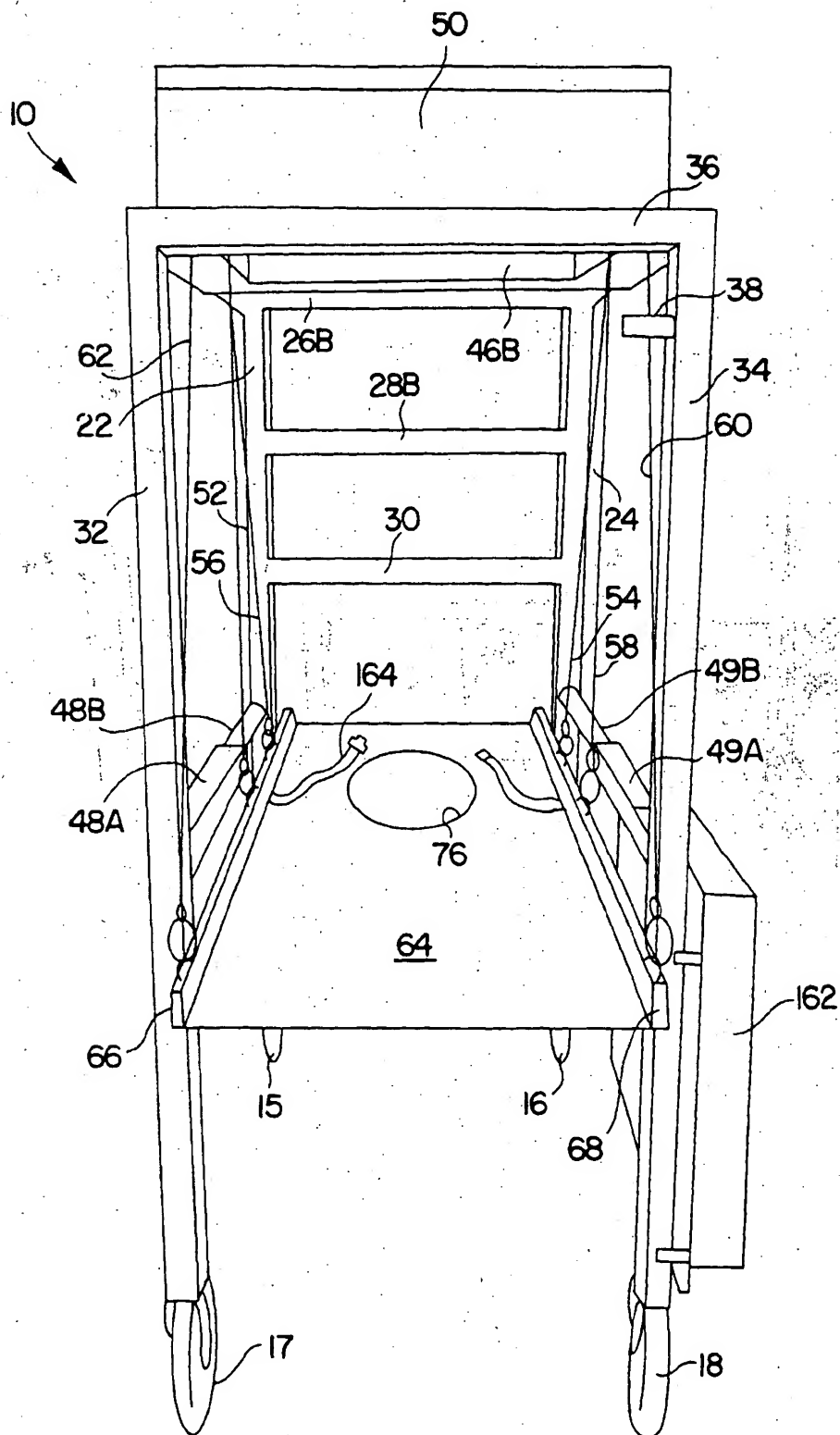


FIG. 10

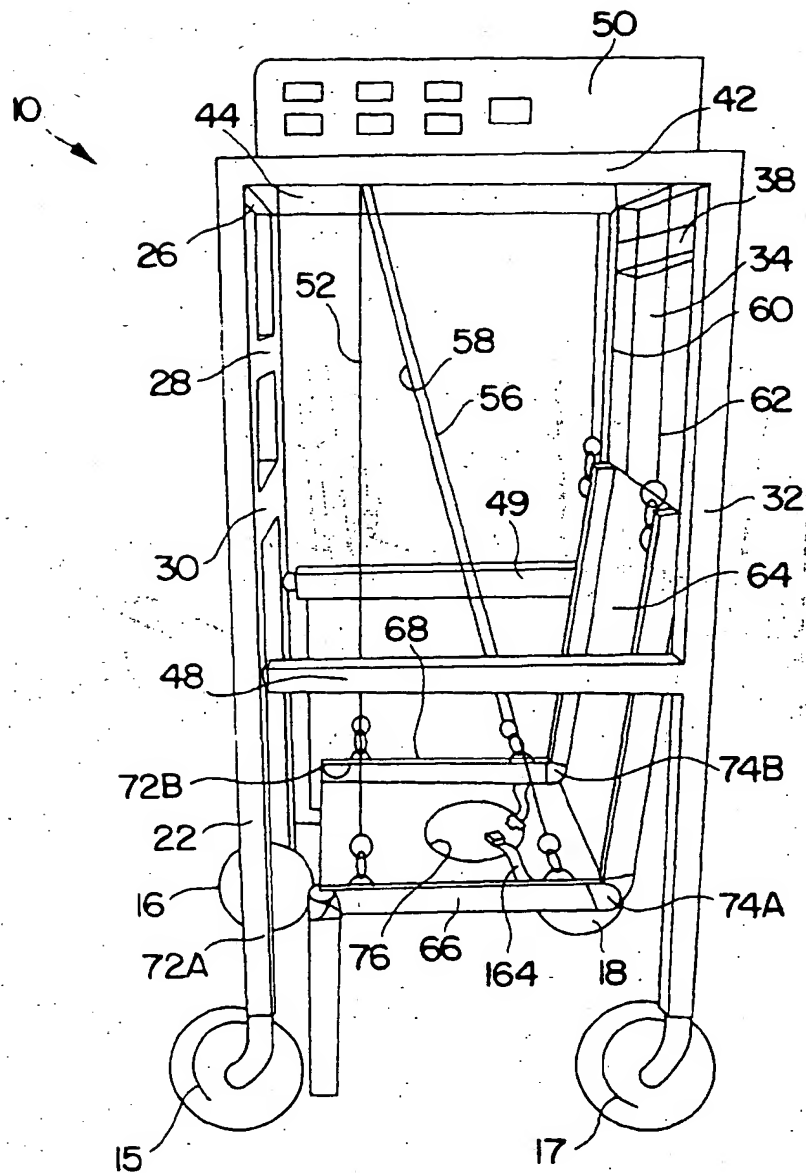


FIG. 11

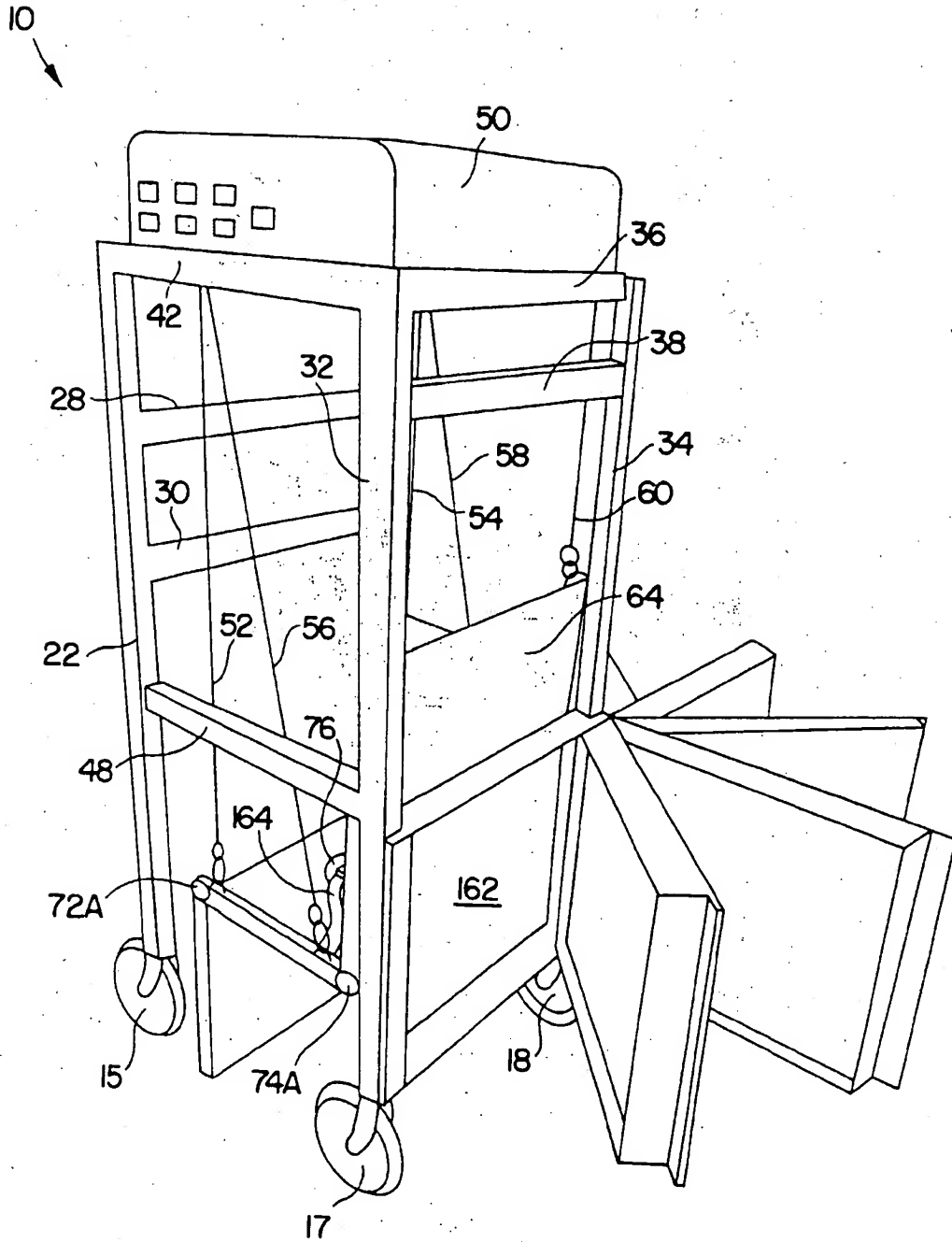


FIG. 12

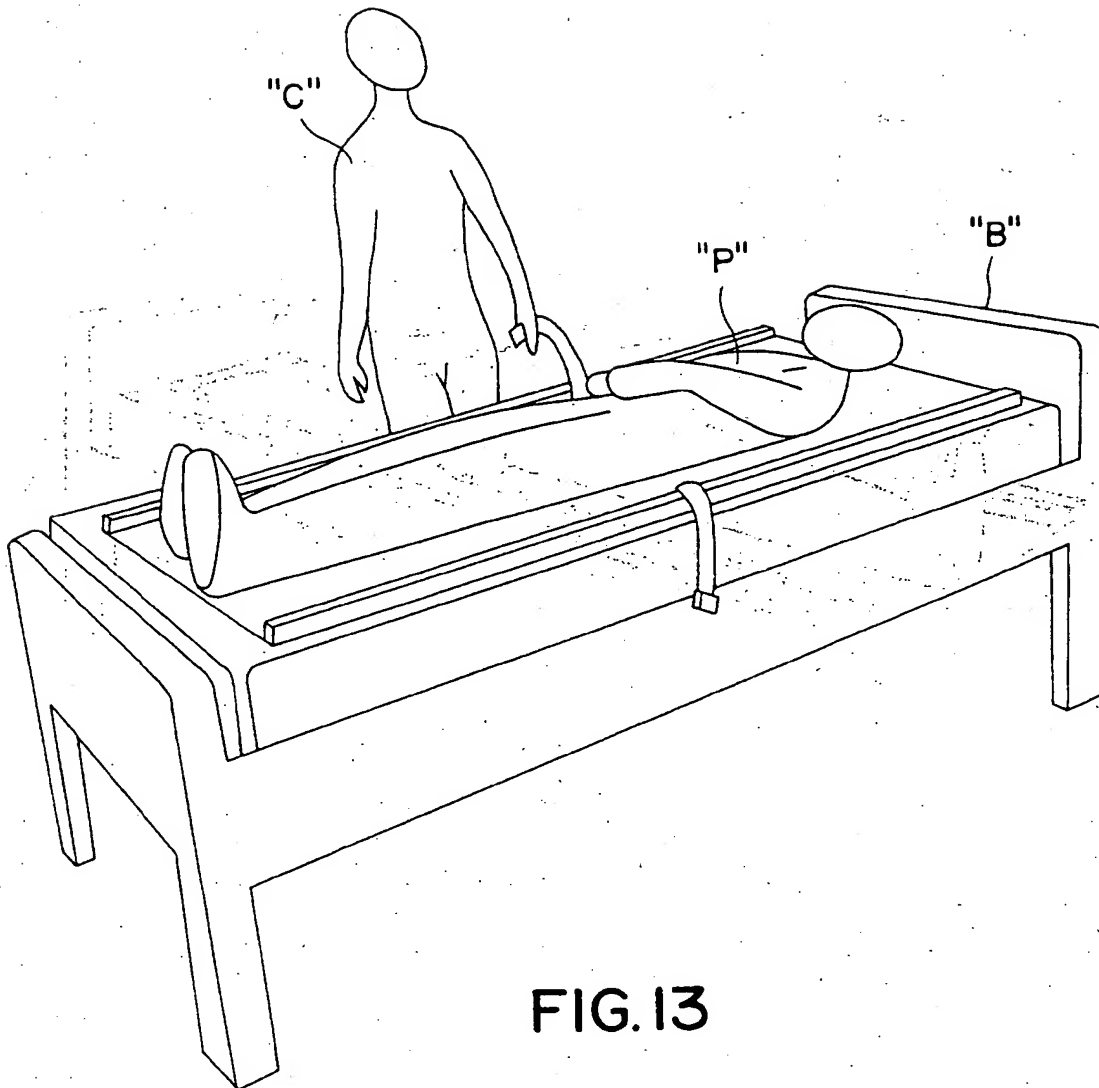


FIG. 13

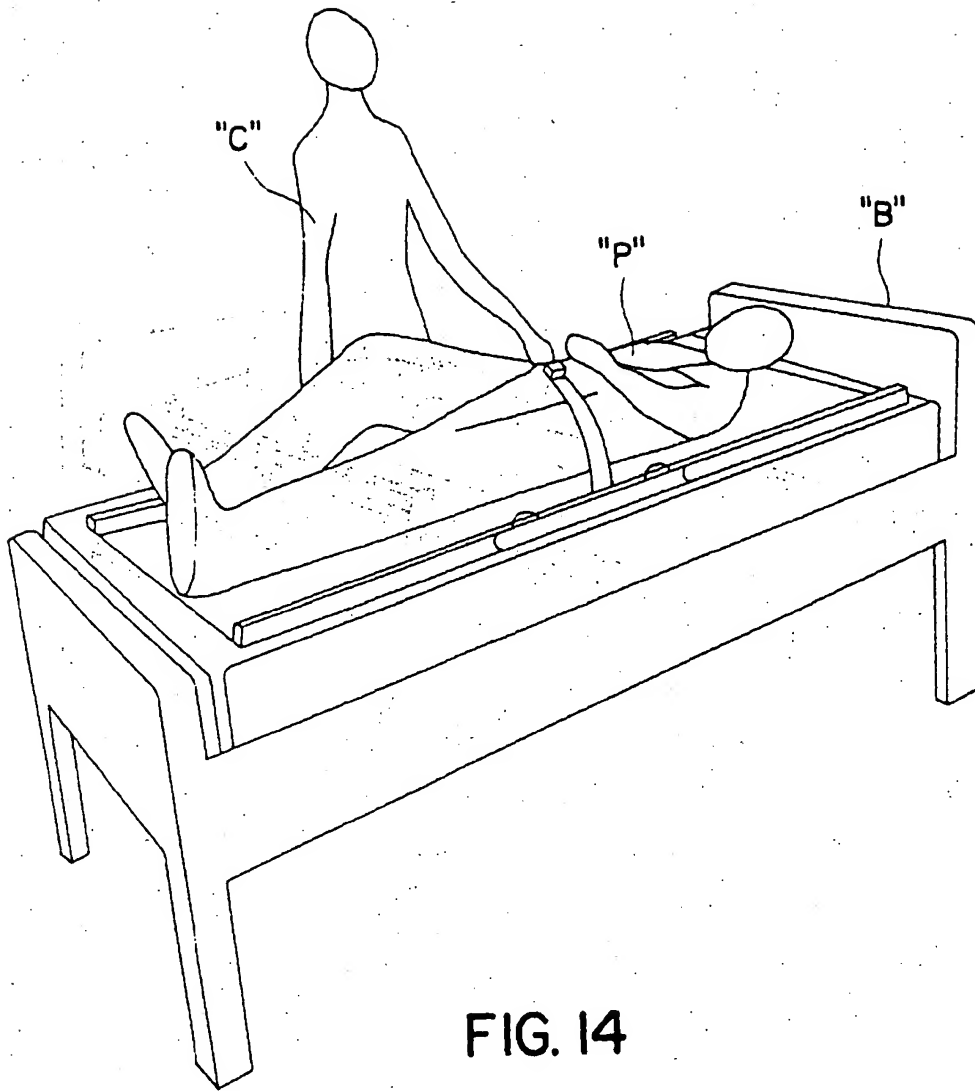


FIG. 14



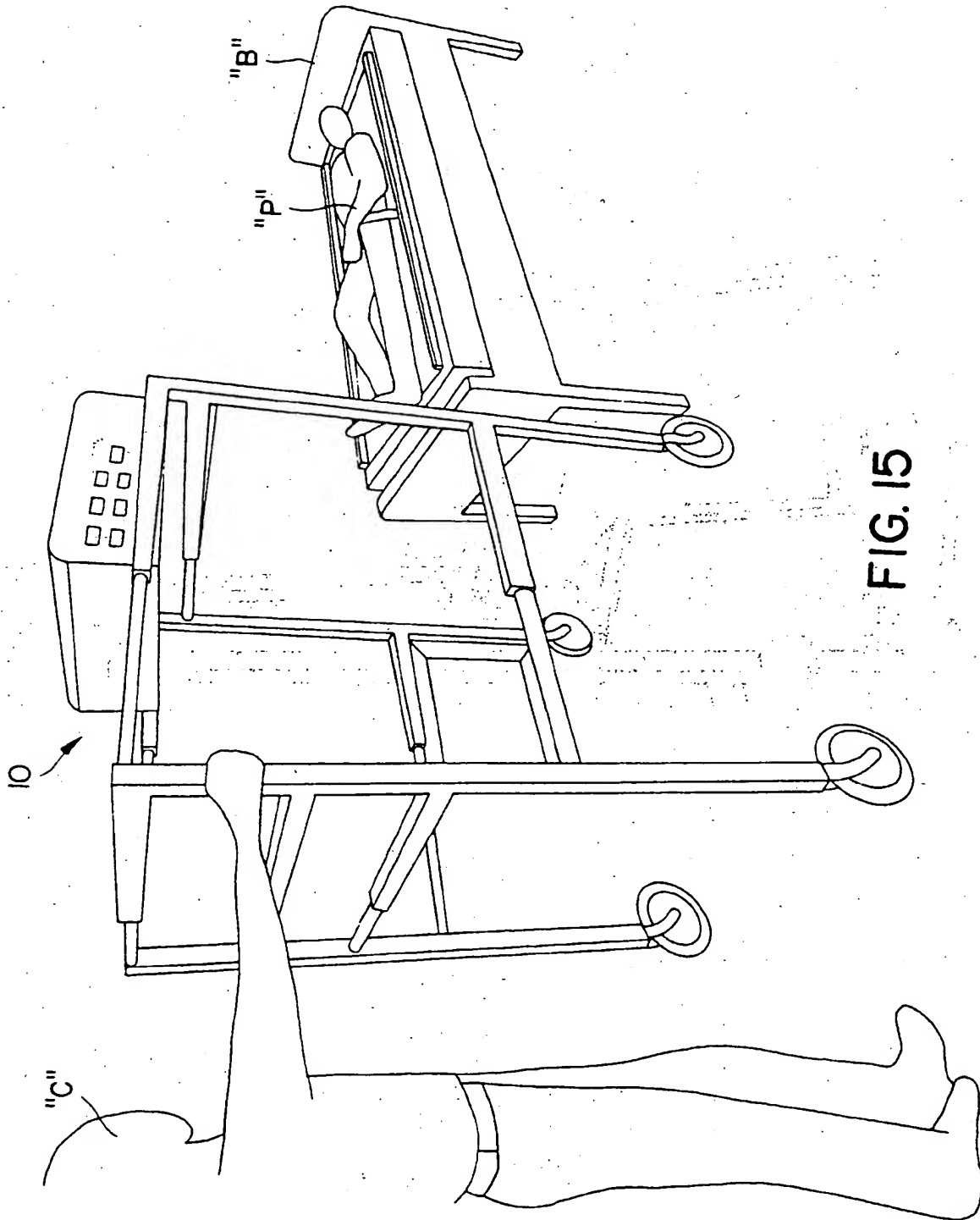
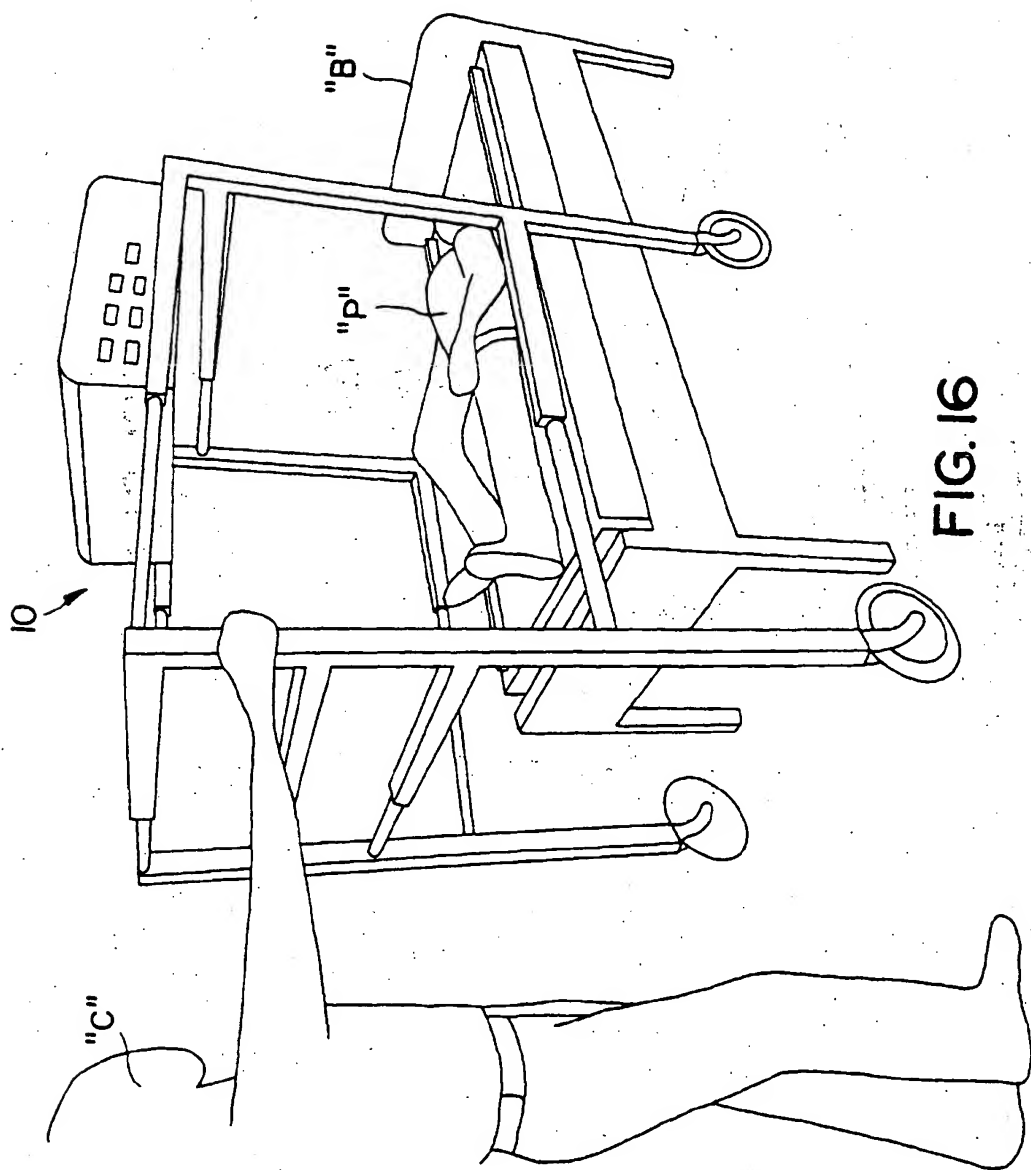
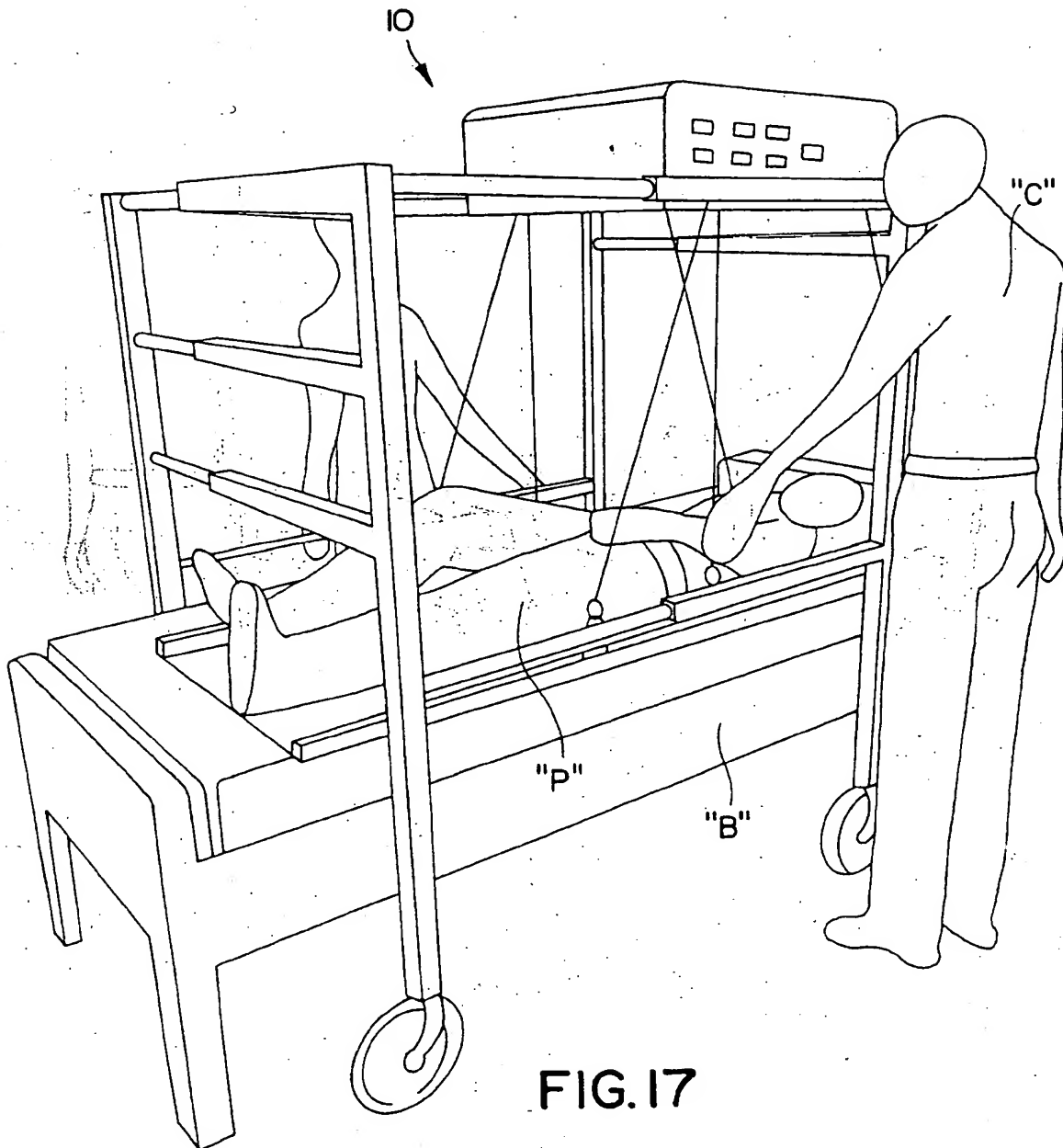


FIG. 15





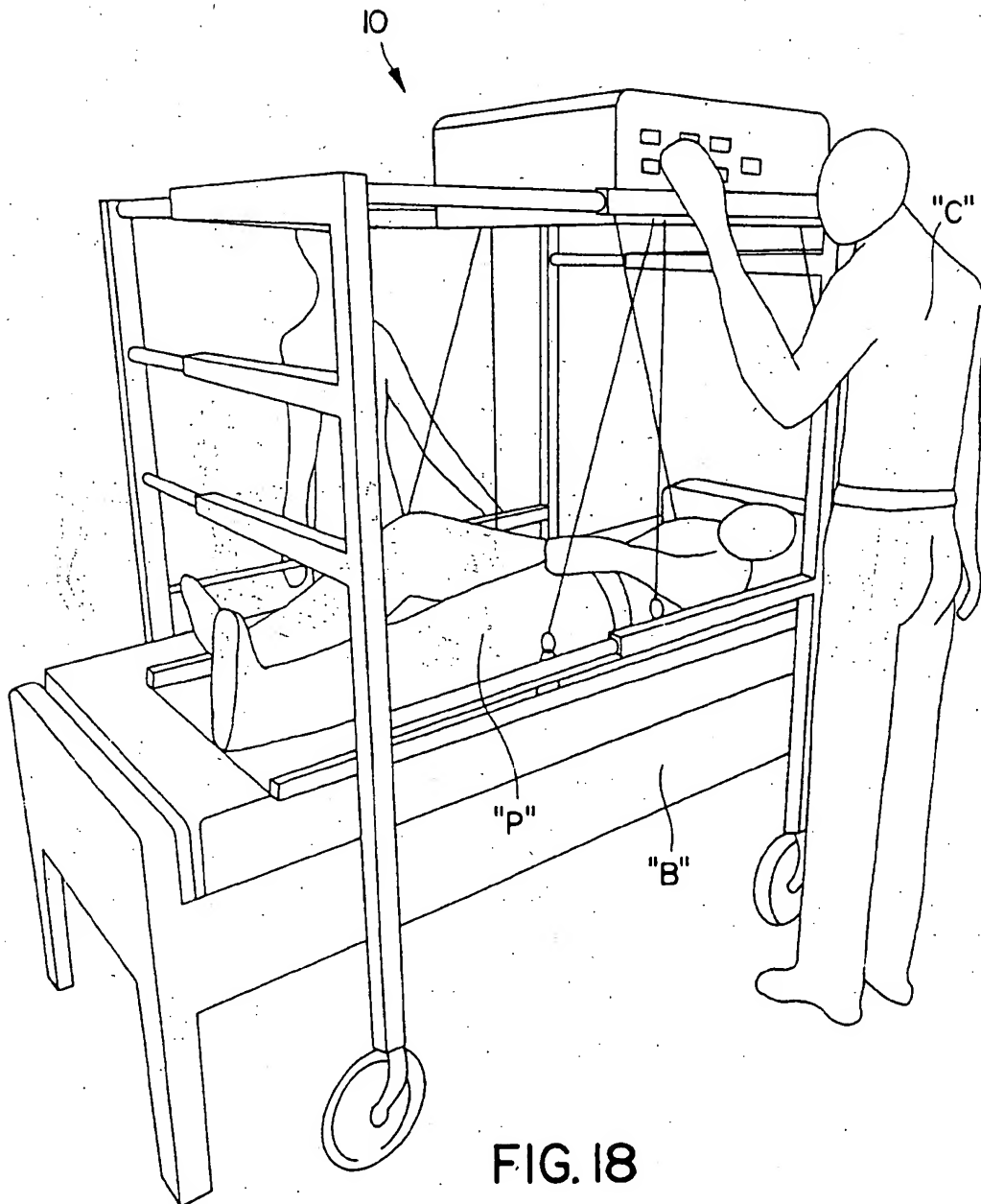


FIG. 18

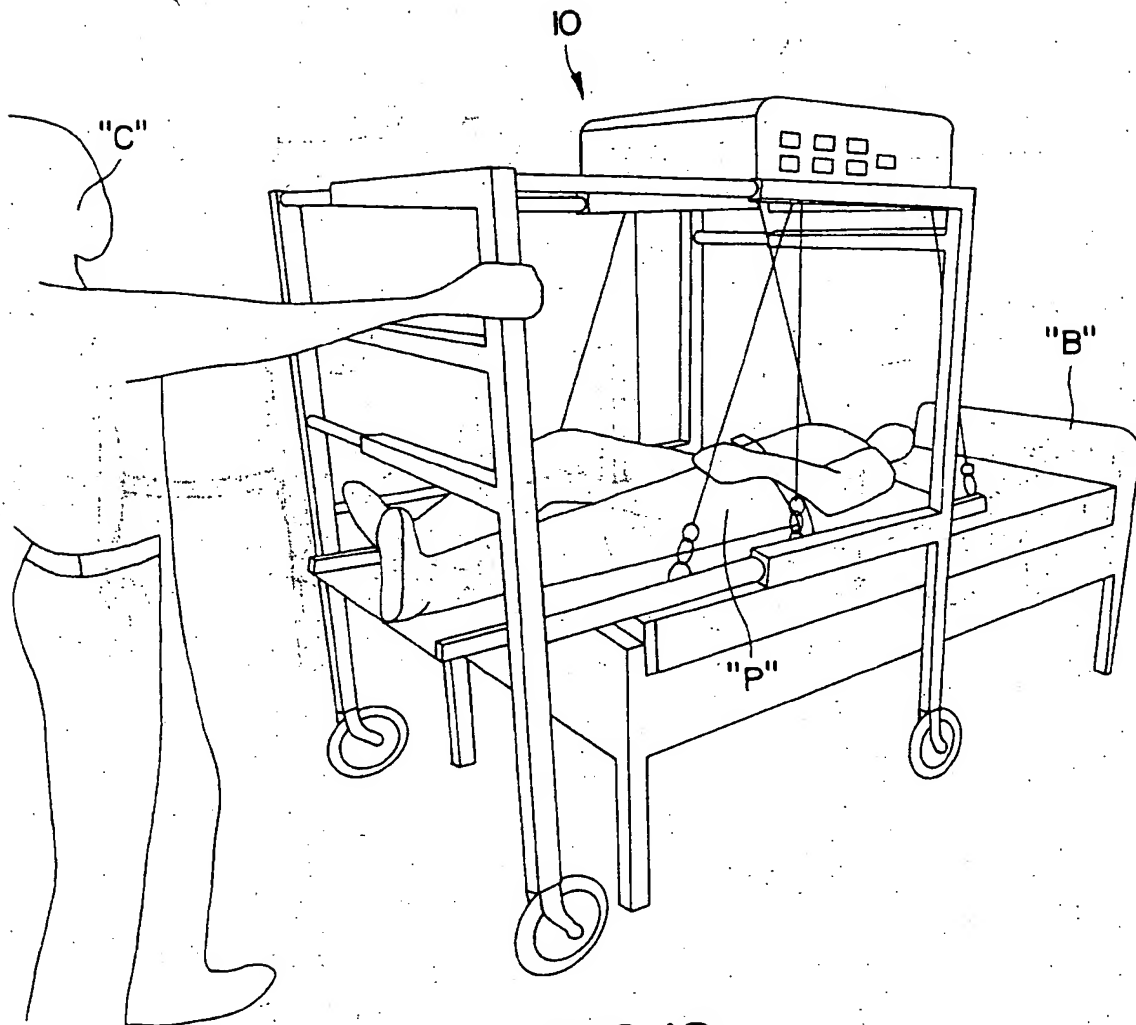


FIG. 19

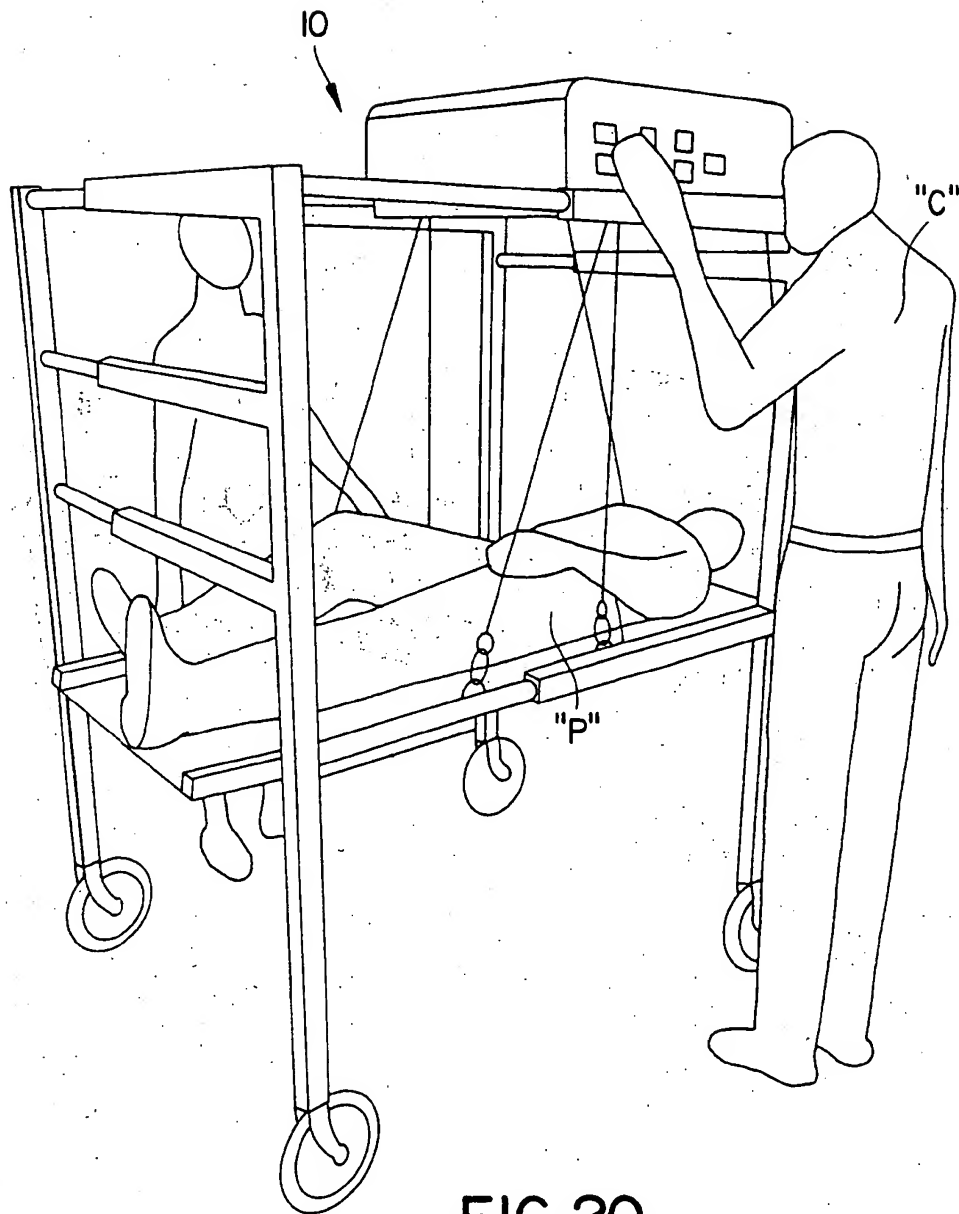


FIG. 20

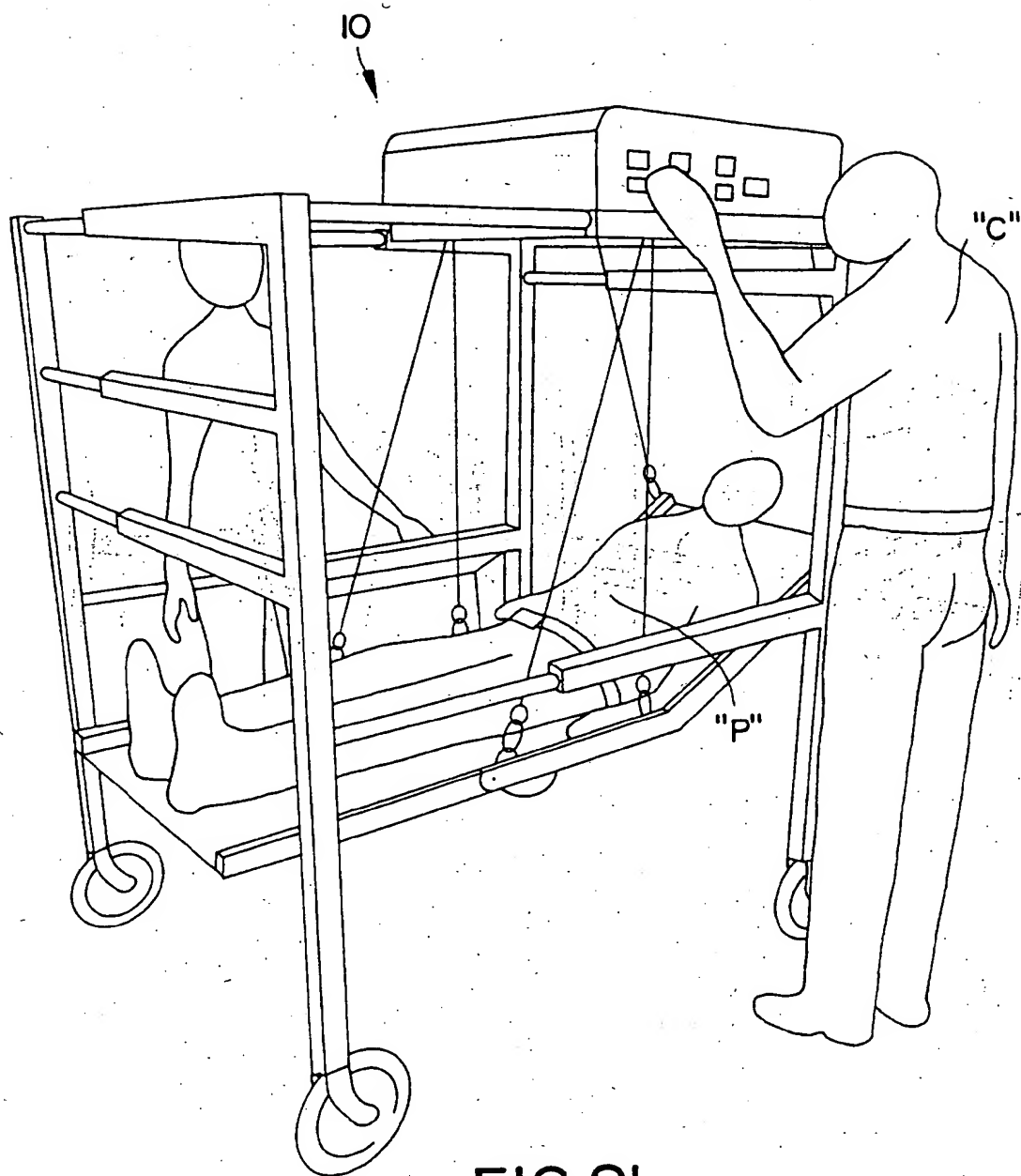


FIG. 21



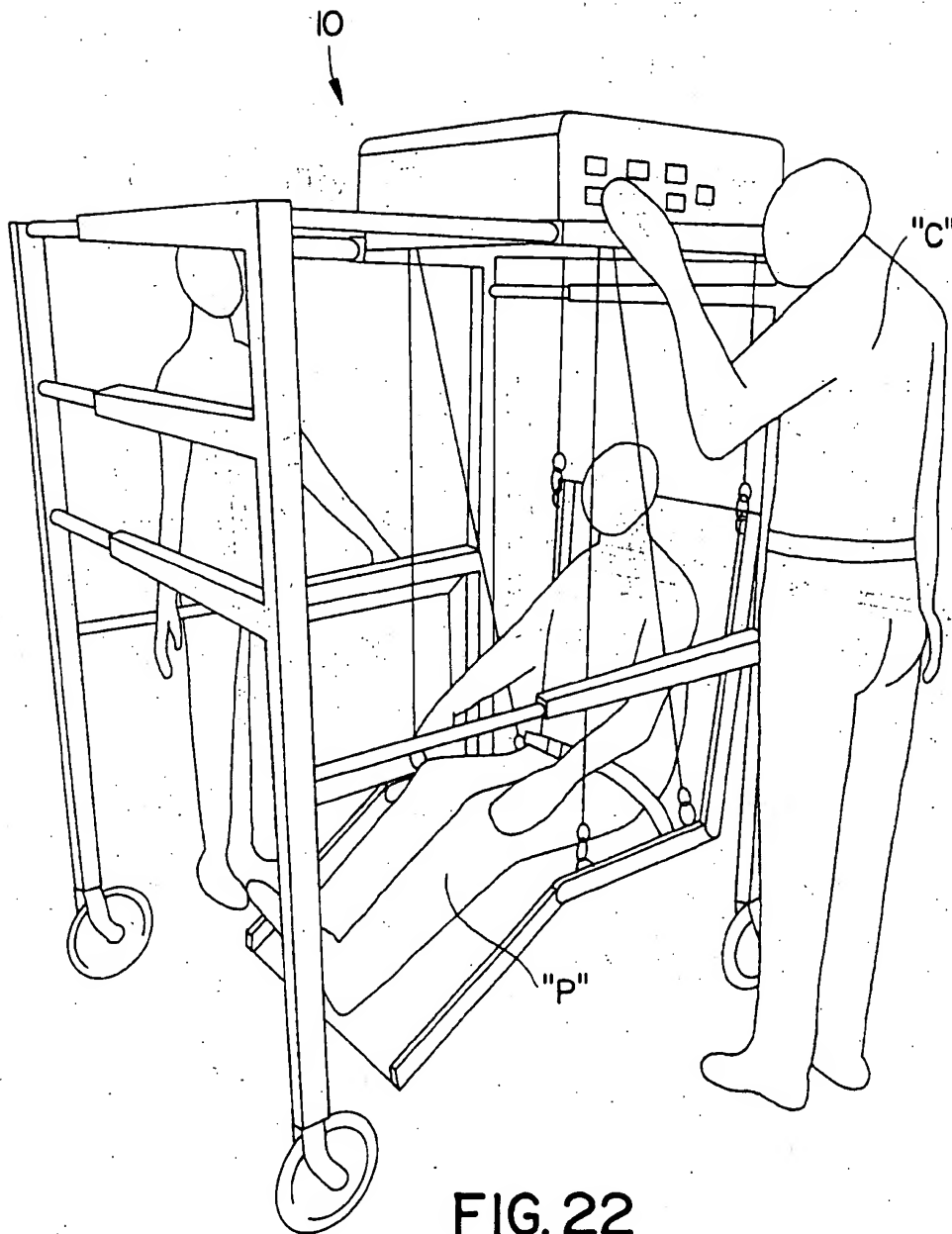


FIG. 22

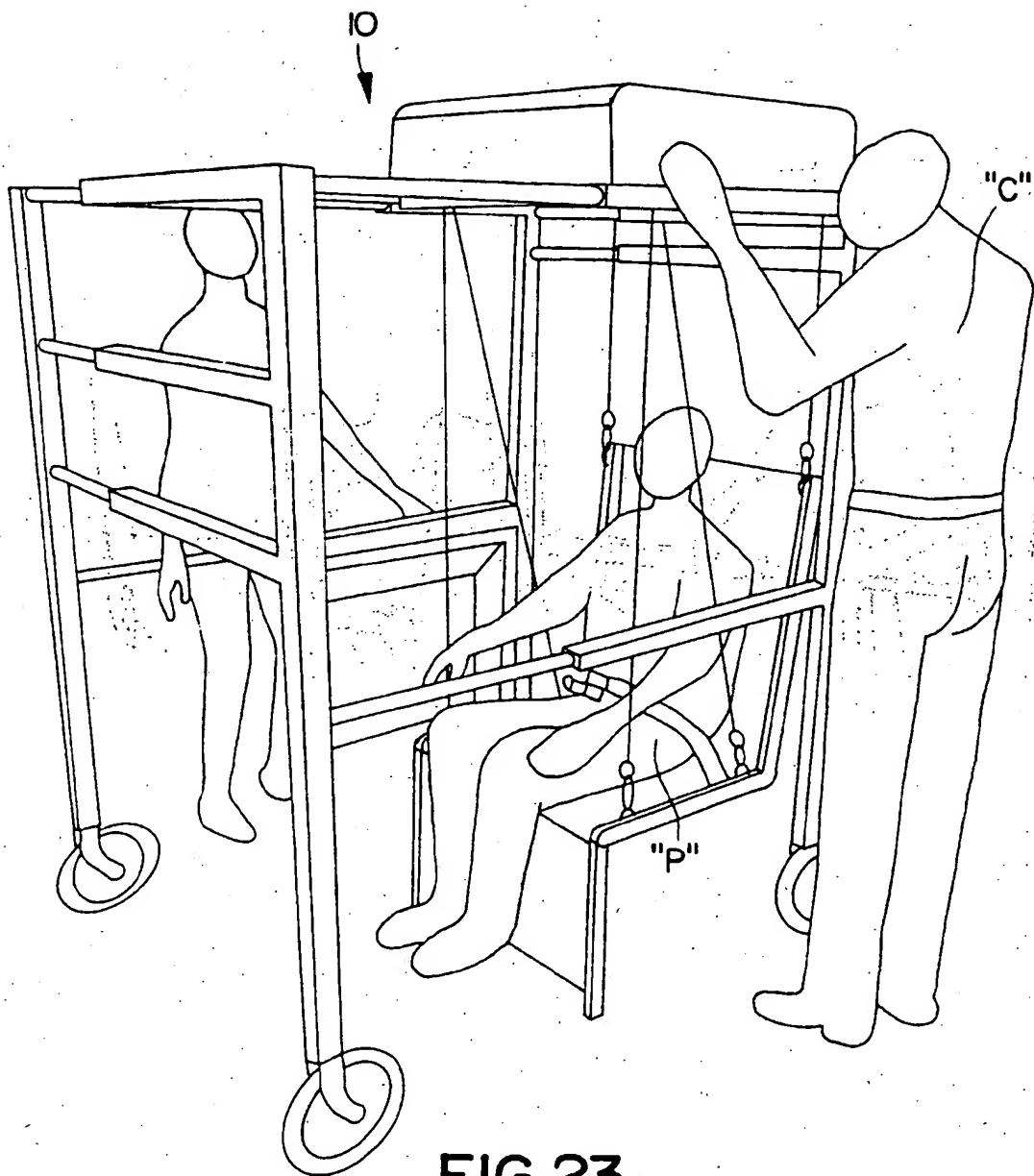


FIG. 23

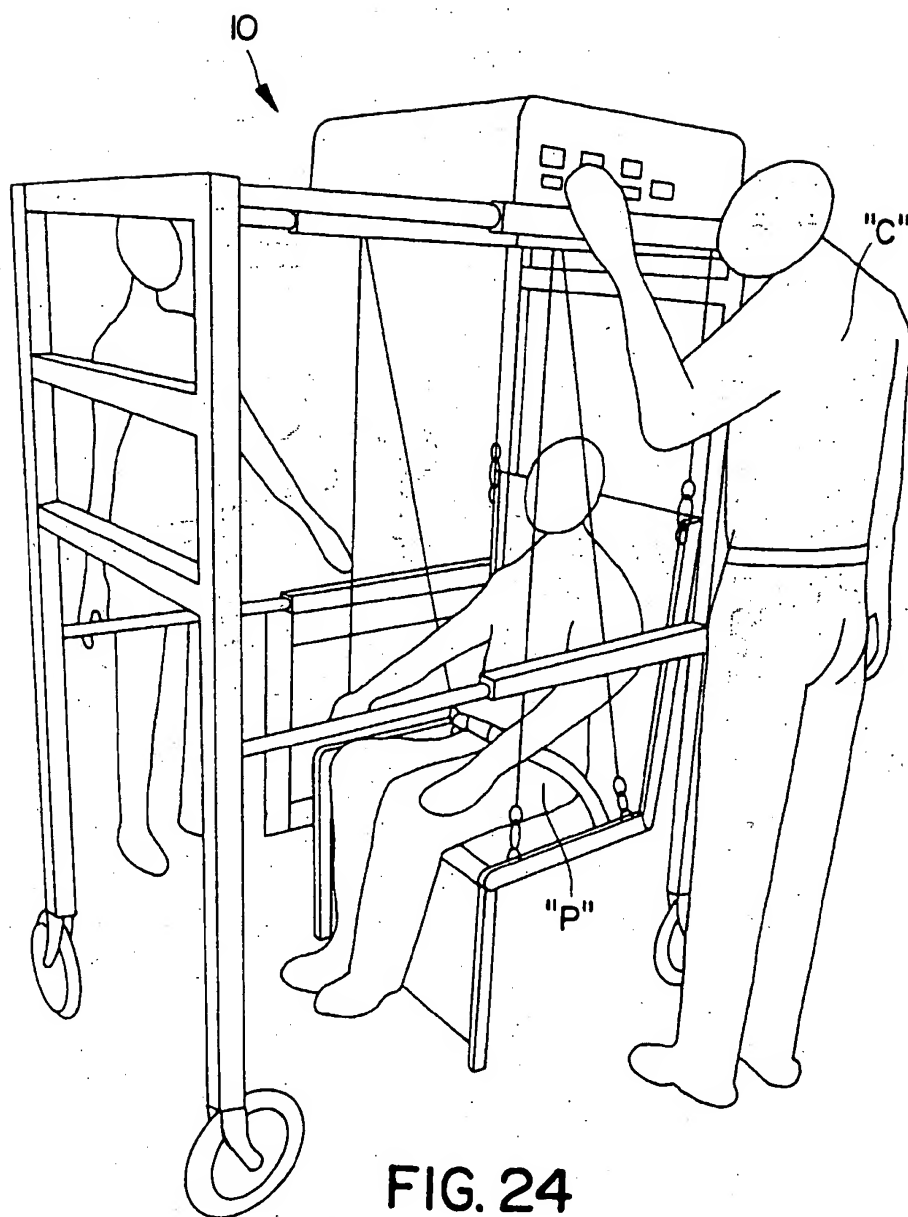


FIG. 24

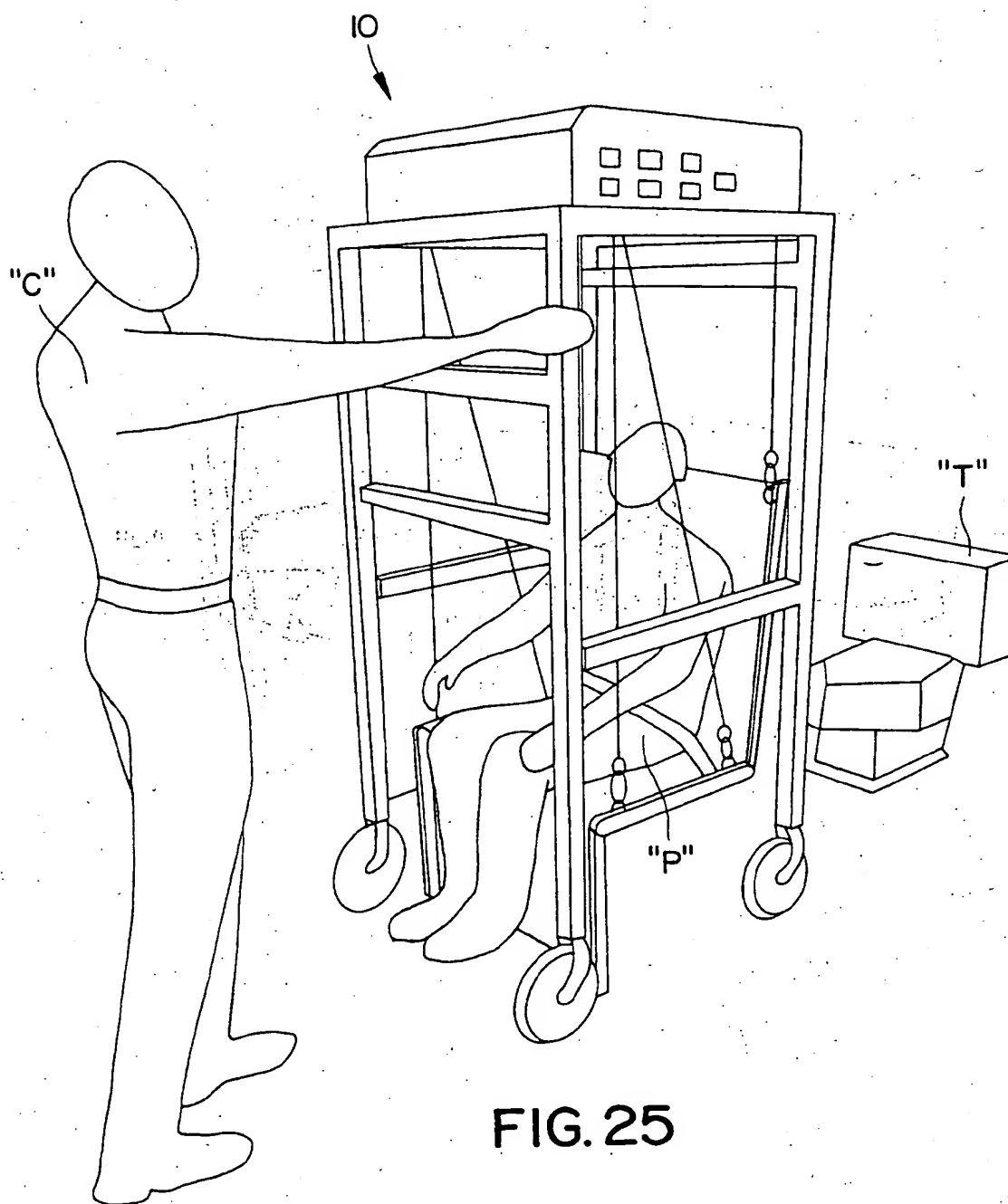


FIG. 25

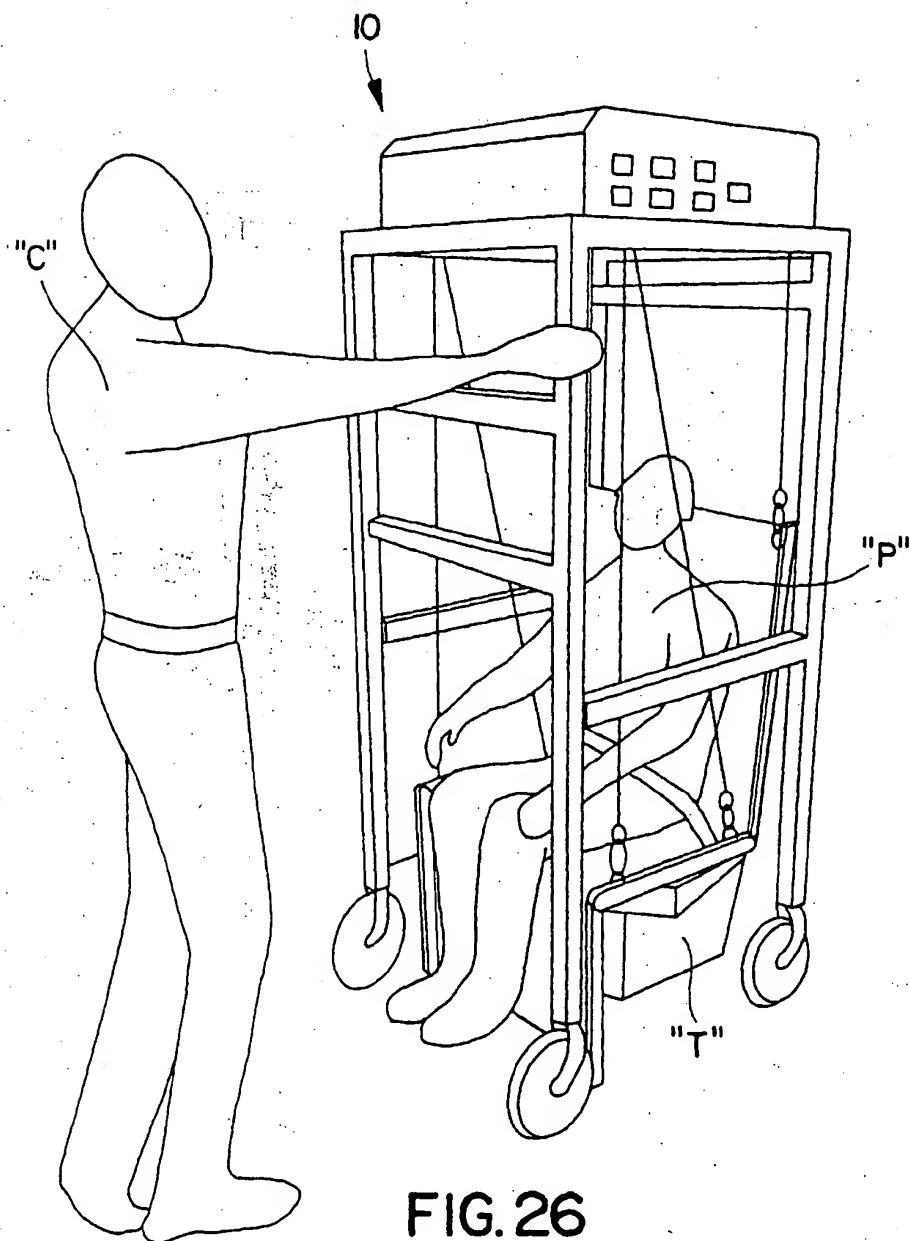


FIG. 26

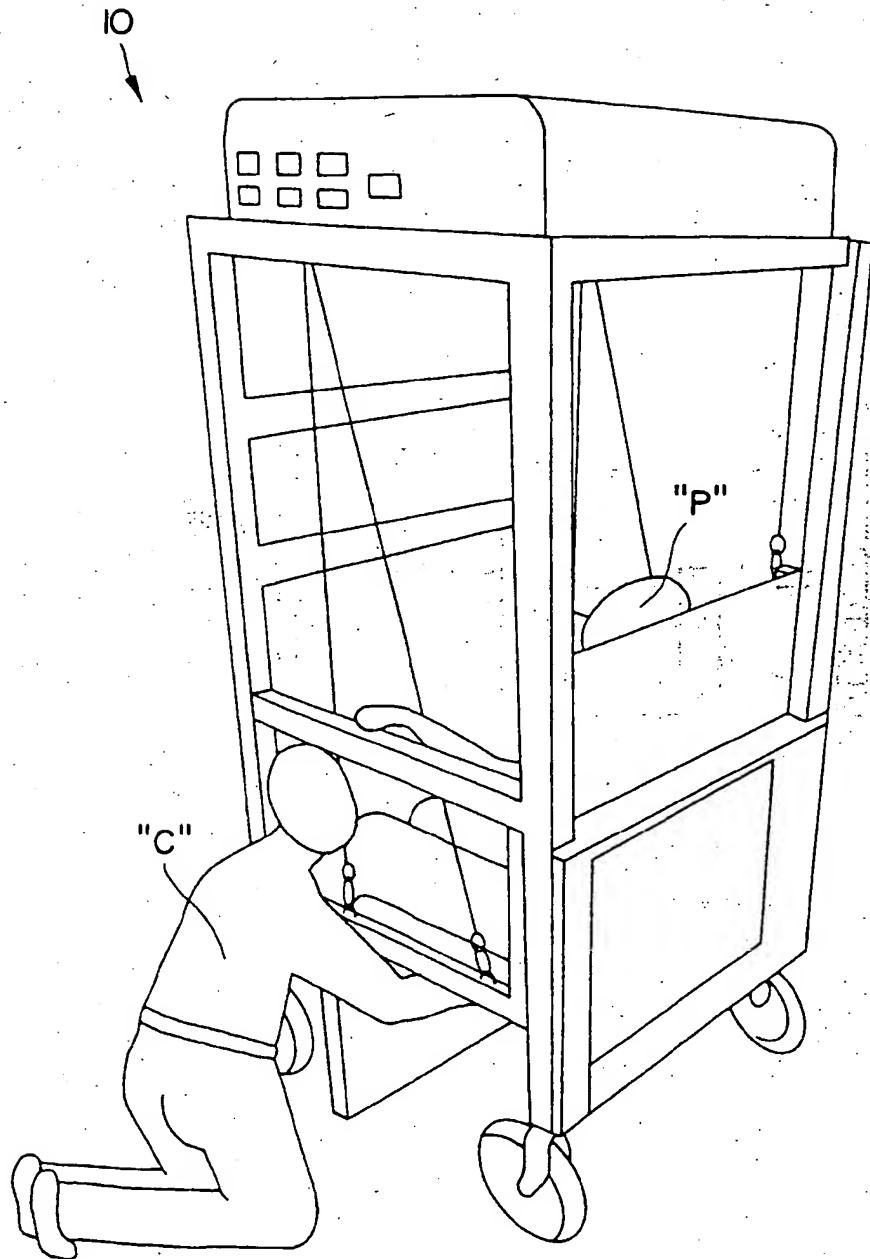


FIG. 27

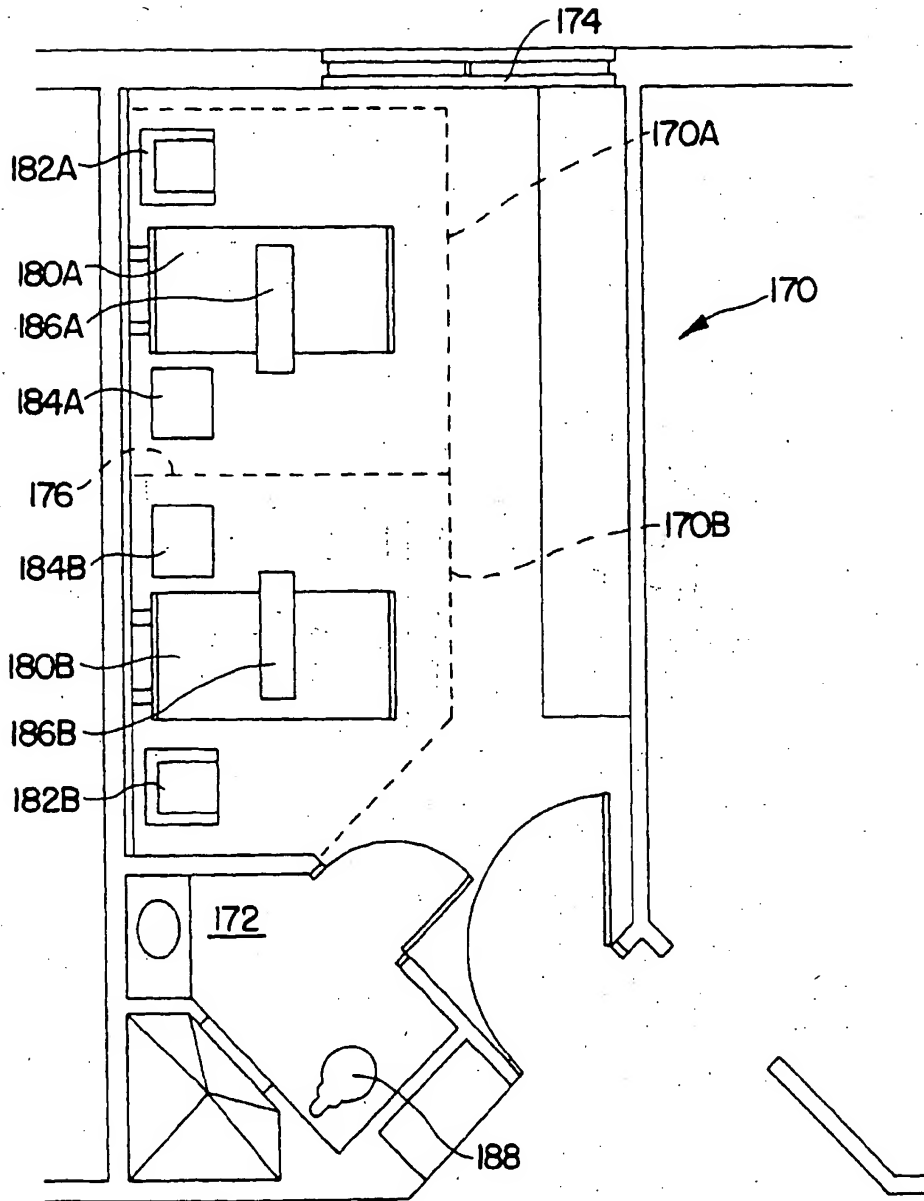


FIG. 28



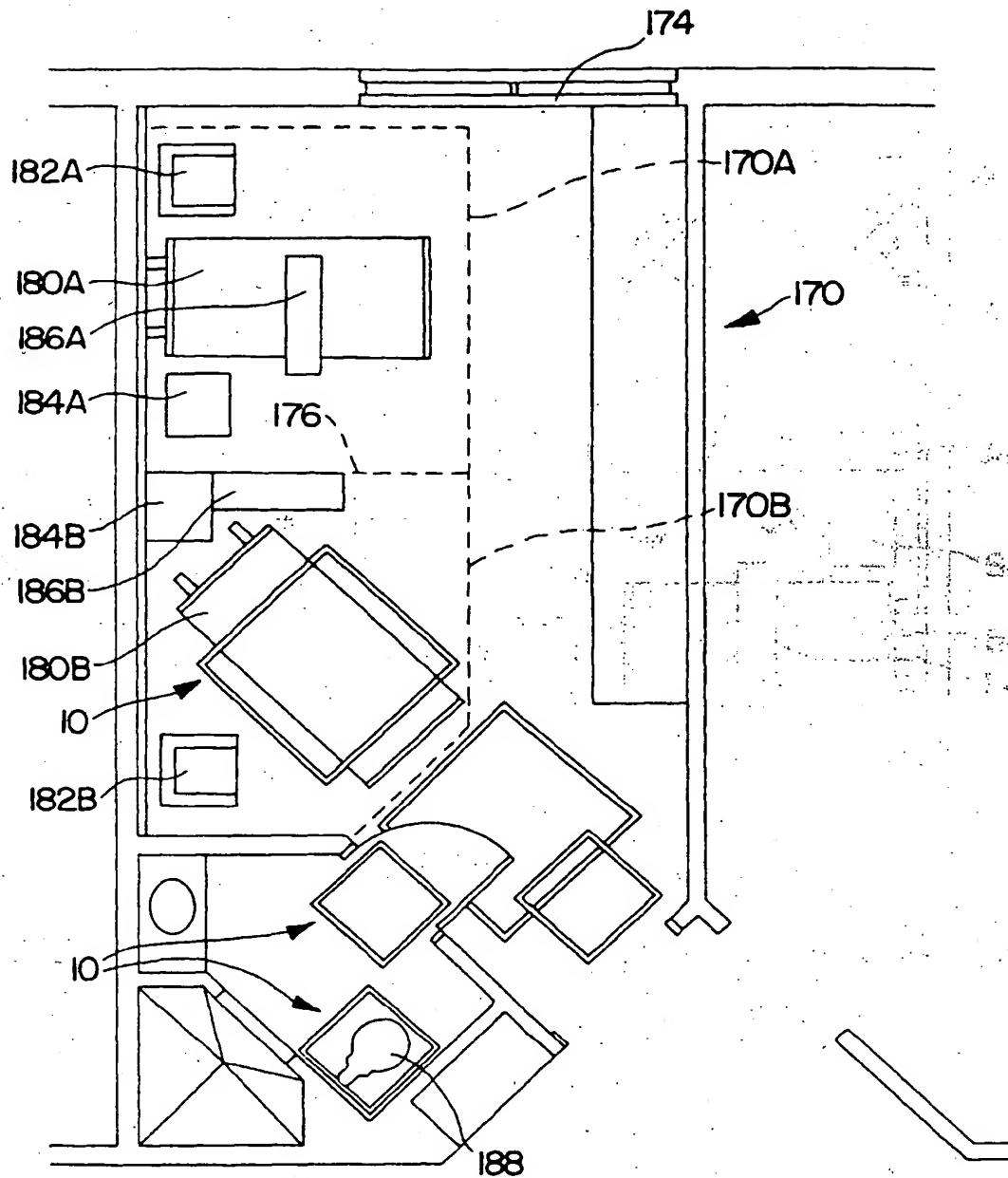


FIG. 29

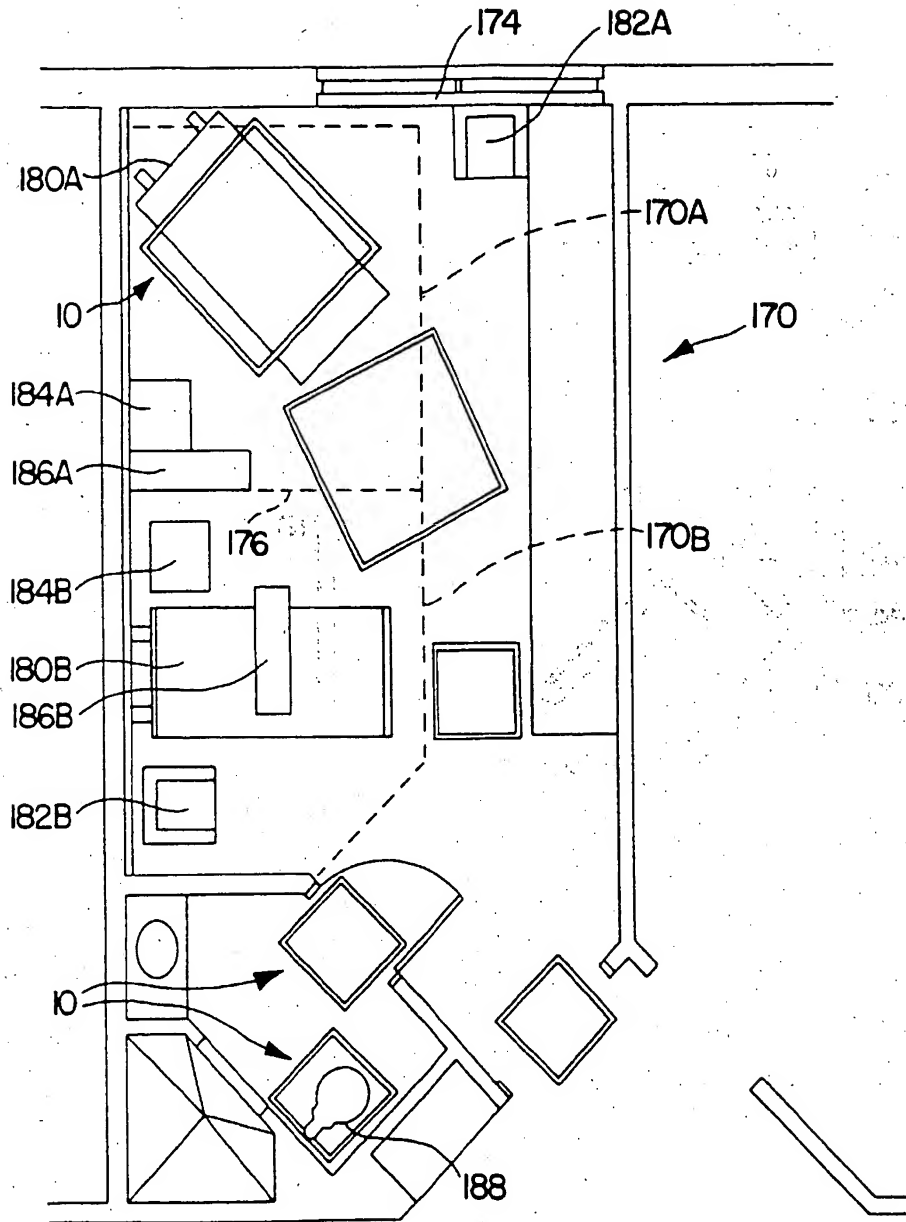


FIG. 30

(19)



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(12)

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(30) Priority: 03.04.1998 US 54728

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### (54) Patient lifting and transport apparatus and method

(57) A convertible patient lifting and transport apparatus 10 comprising a frame assembly 12,14,20 mounted on wheels 15,16,17,18. The frame assembly 12,14,20 defines a patient carriage zone. A patient support 64 is carried by the frame assembly 12,14,20. The patient support 64 is convertible for supporting the patient in the carriage zone in a generally supine position and in a seated position. A mechanical elevating assembly 50 is provided for lifting and lowering the patient support relative to the frame assembly 12,14,20. A frame conversion assembly 30,38,48,49,51 moves the frame assembly 12,14,20 between an open condition wherein the frame assembly 12,14,20 expands for straddling a bed when lifting and removing the patient from the bed, and a closed condition wherein the frame assembly 12,14,20 retracts outside of an area surrounding the bed for transporting the patient to a location away from the bed.

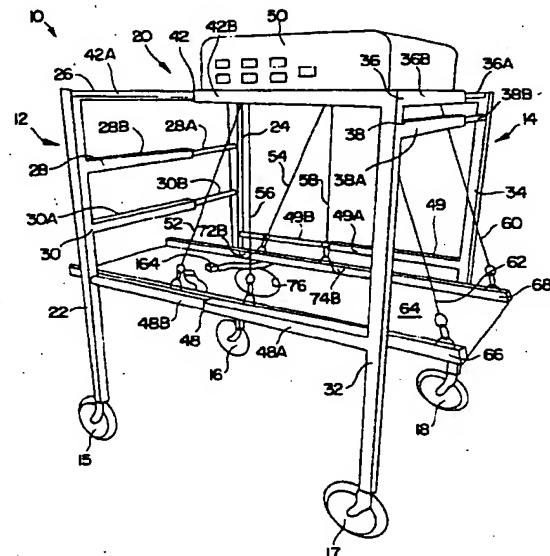


FIG. 1

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## EUROPEAN SEARCH REPORT

Application Number  
EP 98 30 5048

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
A	US 4 384 378 A (GETZ CLARENCE A ET AL) 24 May 1983 (1983-05-24) * column 5, line 3 - line 17; figures *	1,21,23	A61G7/10
A	US 5 544 371 A (FULLER CARMEL U) 13 August 1996 (1996-08-13) * column 4, line 29 - line 35; figures 11-14 *	1,21,23	
A	US 1 977 944 A (HASKETT) 23 October 1934 (1934-10-23) * the whole document *	1,21,23	
A,D	US 5 570 483 A (WILLIAMSON THEODORE A) 5 November 1996 (1996-11-05) * abstract; figures *	1,21,23	
			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
			A61G
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 8 September 1999	Examiner Baert, F
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